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THIS REPORT PRESENTS THE RESULTS OF PLANT ECOLOGICAL STUDIES CONDUCTED AT RMA IN 1986 AND 1987. THE MAJOR OBJECTIVES OF THE VEGETATION STUDIES WERE TO:

1. IDENTIFY, MAP, AND DESCRIBE MAJOR AND MINOR PLANT COMMUNITY TYPES
2. EVALUATE COMMUNITY COMPOSITION, STRUCTURE, AND SUCCESSIONAL STATUS
3. COMPARE THE VEGETATION OF THE ARSENAL WITH TWO OFFSITE LOCATIONS - BUCKLEY AIR NATIONAL GUARD BASE AND THE PLAINS CONSERVATION CENTER.

THE STUDIES PROVIDED INFORMATION USEFUL FOR PLANNING HABITAT ENHANCEMENT AND VEGETATION ACTIVITIES. PARTICULAR EMPHASIS WAS PLACED ON DETERMINING THE EXTENT TO WHICH THE VEGETATION OF RMA HAS BEEN EFFECTED BY CONTAMINATION, PHYSICAL DISTURBANCE, AND PREVIOUS AGRICULTURAL HISTORY OF THE SITE.

APPENDICES: SPECIES LISTS, DATA SUMMARIES FOR ONSITE AND OFFSITE VEGETATION TYPES.

PLATES: VEGETATION MAP, NATURAL RESOURCE AREAS OF SPECIAL INTEREST.

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ADAMS COUNTY, COLORADO

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## 1.0 INTRODUCTION

### 1.1 PURPOSE

This report presents the results of plant ecological studies conducted at the Rocky Mountain Arsenal (RMA) in 1986 and 1987. The studies were performed by Morrison-Knudsen Engineers (MKE) and their subcontractors on behalf of Shell Oil Company (Shell), through the law firm of Holme Roberts & Owen. Much of the information presented in this report has been incorporated into the Biota Remedial Investigation (RI) report for RMA, prepared for the U.S. Army by Hunter/ESE (ESE 1989). The purpose of this report is to provide greater detail on the Shell/MKE studies than was appropriate for the Biota RI report and to present some data not included in that document.

The major objectives of the vegetation studies were to (1) identify, map, and describe major and minor plant community types at the Arsenal; (2) evaluate community composition, structure, and successional status across RMA; (3) compare the vegetation of the Arsenal with two offsite locations; and (4) support wildlife studies (MKE 1989) by quantifying various habitat parameters. The studies also provided information useful for planning habitat enhancement and revegetation activities at the Arsenal. Particular emphasis was placed on determining the extent to which the vegetation of RMA has been affected by contamination, physical disturbance, and the previous agricultural history of the site. Vegetation studies included the collection of extensive quantitative data as well as qualitative observations.

This report includes narrative text, accompanying figures and tables, Appendix A (Species List), Appendix B (Data Summaries for Onsite and Offsite Vegetation Types), Plate I (Vegetation Map), and Plate II (Natural Resource Areas of Special Interest).

## 1.2 LOCATION AND HISTORICAL SETTING

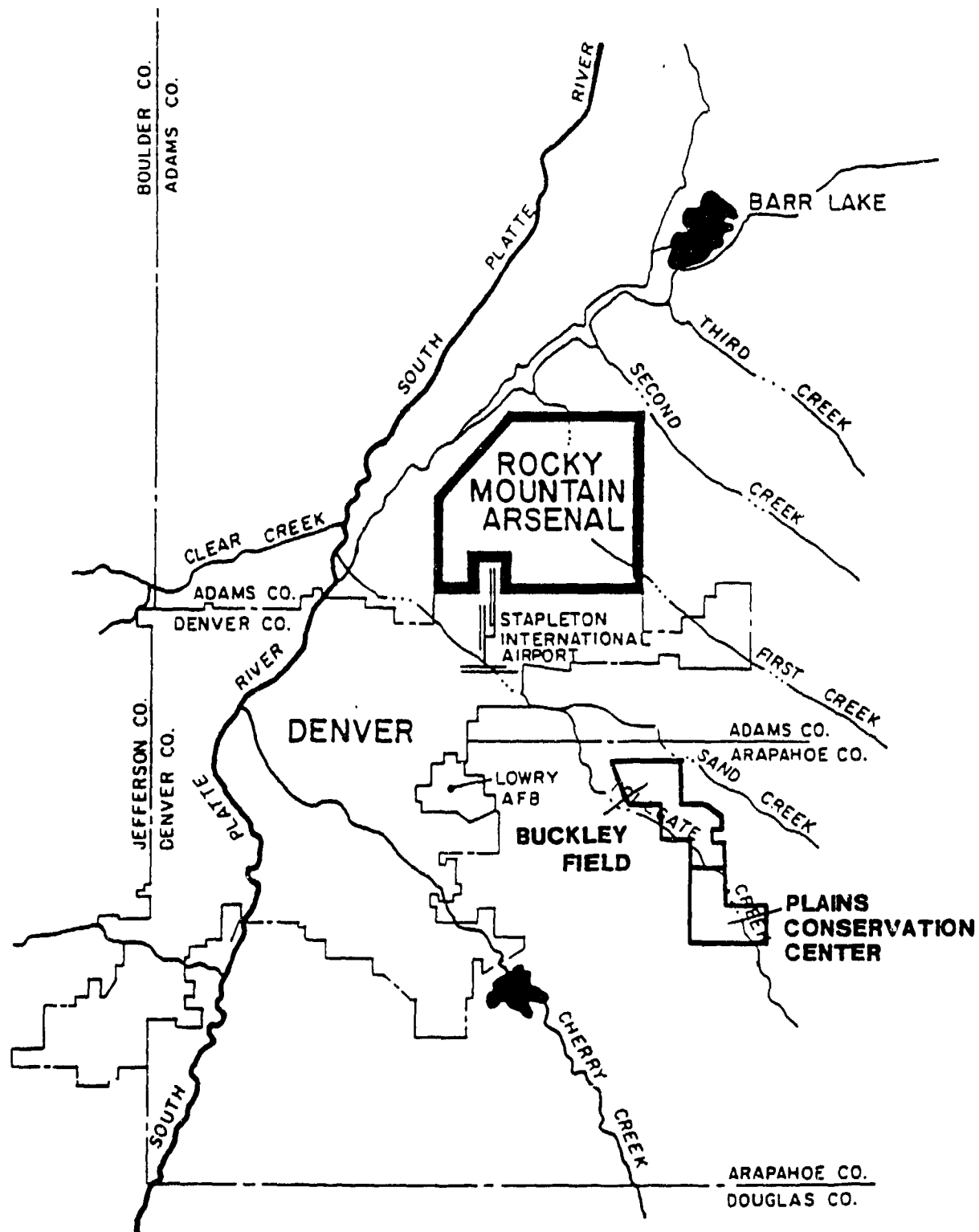
The Rocky Mountain Arsenal is an Army installation covering about 70 square kilometers (27 square miles) in southern Adams County, Colorado, about 16 km (10 mi) northeast of Denver (Figure 1-1). Before the Arsenal was established, the area was used primarily for rangeland and dryland agriculture, mostly as small farms and ranches. This land use still dominates areas to the north and east of RMA.

The RMA was originally established in 1942 as a facility for the manufacture of chemical and incendiary munitions. After the war, the Army continued to produce, store, and demilitarize chemical agents at the Arsenal. Later, several of the facilities in the South Plants were leased to private chemical manufacturing companies. Starting in 1947, Colorado Fuel and iron (CF&I) manufactured chlorinated benzenes and DDT. During that same year, Julius Hyman and Company (Hyman) began production of a variety of pesticides. Hyman leased land that had been covered by the CF&I lease in 1950. In May 1952, Shell acquired the stock of Hyman and continued manufacturing pesticides until 1982.

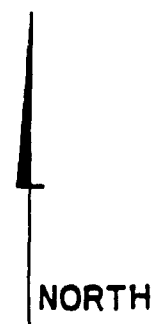
At present, most activity at the Arsenal is limited to three categories: (1) administration, maintenance, and security; (2) technical investigations related to remediation of the site; and (3) interim actions to stabilize or remedy various "hot spots." Other activities are related to habitat improvement and wildlife management.

## 1.3 OFFSITE STUDY AREAS

Vegetation studies included two offsite areas -- Buckley Air National Guard Base (Buckley) and the Plains Conservation Center (PCC). The two offsite areas have environmental conditions similar to those at RMA.



**FIGURE 1-1**  
**LOCATION MAP**



Buckley is located approximately 8 km southeast of the Arsenal in northern Arapahoe County and covers about 13 km<sup>2</sup> (Figure 1-1). Although runways and buildings occupy much of the central portion of the facility, remnants of the original prairie occur around the periphery, as do areas planted to crested wheatgrass or other introduced pasture grasses. PCC is an ecological preservation and education facility covering approximately 8 km<sup>2</sup> immediately south of Buckley (Figure 1-1). Vegetation at PCC is mostly native prairie, with some dryland agriculture. The prairie vegetation has been somewhat altered by years of cattle grazing. Pronghorn antelope also graze the site.

## 2.0 ENVIRONMENTAL SETTING

### 2.1 PHYSIOGRAPHY AND TOPOGRAPHY

Rocky Mountain Arsenal is located at the western edge of the High Plains Section of the Great Plains Province (Thornbury 1965, Hunt 1967). Foothills of the Southern Rocky Mountain Province begin approximately 23 km to the west. Topography of the Arsenal is gently rolling, with an elevation range from 1,622 meters at the southeastern boundary to 1,566 m along the northwestern boundary. Two small hills, "Rattlesnake Hill" (1,615 m) and "Henderson Hill" (1,600 m), are located in central and northeastern RMA, respectively.

### 2.2 SURFACE WATER

Surface runoff on the Arsenal flows generally northwestward toward the South Platte River, which roughly parallels the northwestern boundary at a distance of about 3.2 km. The largest and most important surface drainage on the Arsenal is First Creek, which has a total length onsite of 9.4 km. First Creek originates in Arapahoe County, 32 km east of Denver. In dry years, the flow of First Creek on the Arsenal is continuous only during the spring and following major storms. In general, however, it may be characterized as a fairly persistent stream. The persistence of flow is evidenced by well-developed hydrophytic and phreatophytic vegetation along much of its length.

North Bog Pond is located just west of First Creek near the northern boundary. The pond is significantly augmented by excess water from the nearby North Boundary Containment/Treatment System. The surrounding bog--actually a small marsh fed by a seep--is natural and pre-dates the Arsenal. Another small pond referred to by MKE as "Duckweed Pond" is located in the sandhills of eastern Section 12.

Artificial bodies of water at RMA include a series of four impoundments known collectively as the South Lakes or Lower Lakes (Lake Mary, Lake Ladora, Lower Derby Lake, and Upper Derby Lake), plus three smaller impoundments. The smaller impoundments are Rod and Gun Club Pond, located in a natural depression south of Lower Derby Lake; Toxic Storage Yard Pond, along First Creek in the east-central part of the site; and Havana Pond, which collects runoff from residential and commercial/industrial areas south of the Arsenal.

### 2.3 GEOLOGY AND SOILS

Surficial deposits on the RMA consist of stabilized eolian sand and alluvium composed of sand, silt, and gravel. This surface veneer is generally less than 15 m thick across most of the Arsenal. The Cretaceous Denver Formation, consisting of 120-190 m of interbedded shale and sandstone, underlies the surficial deposits.

Soils of the RMA include clayey soils on nearly level upland surfaces, especially in the northern portion of the site; sandy eolian soils on rolling upland surfaces, especially in the southern portion of the site; and loamy to sandy stratified alluvial soils on the floodplains and low terraces of drainages. These soils generally are deep and well drained. Most show clay and, to a lesser extent, lime enrichment in the subsoil.

### 2.4 CLIMATE

The climate of the region is sunny and semi-arid and generally lacks prolonged periods of very cold or very hot weather. The region averages about 30 days with highs above 32°C (90°F) and 150 days with lows below 0°C (32°F) per year; the average growing season is 180 days. Mean maximum and minimum temperatures are about 5°C (41°F) and -11°C (12°F) for January, and 29°C (85°F) and 13°C (55°F) for July.



mean annual precipitation of the region is about 39 centimeters (15.5 inches). The wettest season is spring, which is characterized by occasional wet snow and periods of steady rain. Precipitation gradually declines through the summer, usually occurring as brief but occasionally intense thunderstorms, then decreases further during fall and winter. The growing season receives about 75 percent of the total yearly precipitation. Winters are relatively dry, and desiccating high intensity winds ("chinooks") are common. Relative humidities are generally low throughout the year, with monthly averages of about 50-60 percent and numerous days below 10 percent.

## 2.5 WILDLIFE

The terrestrial wildlife of the Arsenal includes species characteristic of grassland, prairie woodland, wetland, and agricultural habitats. The habitat diversity, size, and isolation provided by RMA have resulted in some wildlife species occurring at greater densities than in surrounding areas and mesic bottomlands. Groves of trees, shrub thickets, wetland areas, and weedy grasslands provide habitat for 200-300 mule deer and white-tailed deer. Pheasants are abundant, particularly in weedy areas. Grasslands provide habitat for a large population of black-tailed prairie dogs, which in turn provide important prey for badgers, coyotes, bald eagles, ferruginous hawks, and other predators. Mature cottonwood trees along drainages are used by bald eagles as roost sites during winters. Surface waters and associated wetlands are important for muskrats, waterfowl, wading birds, and amphibians.

## 2.6 VEGETATION

The RMA lies within the North Temperate Grassland biome (Shelford 1963), which basically extends from north-central Texas into central Alberta, and from Indiana into portions of California. The specific region surrounding the Arsenal is frequently referred to as the High Plains district of the

northern Great Plains province. The region typically is dominated by a mosaic of grassland communities with a diverse component of perennial forbs ("wildflowers"). Shortgrass species tend to occur in more xeric (dry) sites, with tallgrass species in more mesic (moist) sites. Throughout the region, however, there exists considerable gradation and mixing between these two extremes.

Prior to settlement, prairie wildfires and grazing by bison, proghorn, and elk may have played a major role in maintaining the grassland vegetation. In modern times, most of the original vegetation has been destroyed by plowing and overgrazing of domestic livestock. Control of fire has also caused shifts in species dominance. The following paragraphs briefly describe the potential "climatic climax" (i.e., long-term, self-sustaining) vegetation of the region as portrayed by Kuchler (1964). The climax communities are those that occur in the absence of disturbance.

At the western edge of the Great Plains, where the prairie gives way to the mountains, grassland communities are mixed and variable, owing to the diversity of topography, soils, and climate. Dry upland areas with loamy soils are characterized by warm-season shortgrass species, particularly blue grama and buffalo grass. These species have shallow, fibrous roots that are very efficient at extracting soil moisture following the brief summer showers, as well as deep roots that allow them to survive extended drought. In rocky uplands, where soil moisture is more available, green needlegrass, side-oats grama, prairie junegrass, little bluestem, and Sandberg bluegrass may predominate. Western wheatgrass dominates in areas where fine soil has accumulated, such as shallow depressions and broad drainageways. In moist bottomlands, big bluestem can form nearly pure stands. Prevalent species on sandy soils may include sand sagebrush, needle-and-thread, sand dropseed, prairie sandreed, sand bluestem, switchgrass, red three-awn, and Indian ricegrass.

The occurrence of forbs in the grasslands is variable depending upon substrate and climate. Common perennial forbs in addition to those already named include American vetch, prairie-clover, silvery lupine, white penstemon, prairie coneflower, prairie aster, hairy golden-aster, western wallflower, scarlet globemallow, scarlet butterfly-weed, skeleton-weed, green-thread, evening-primrose, sand verbena, and wild-buckwheat. Prickly pear cactus and pasture sage may be locally abundant. Annual forbs include woolly plantain, prairie peppergrass, western ragweed, and narrowleaf goosefoot. Six-weeks fescue, an annual grass, is a widespread component.

Riparian woodlands and associated wetland areas occur along water courses extending from the mountains onto the plains. Plains cottonwood and peachleaf willow dominate the overstory, with lesser numbers of box-elder and hackberry. The understory includes shrubby willows, as well as variety of midgrass and tallgrass species such as yellow Indiangrass, slender wheatgrass, switchgrass, and Canada wildrye. Golden currant, wild rose, chokecherry, and snowberry may also occur in moist areas; wild plum and hawthorn may form dense thickets in such sites. Cattails and bulrushes may dominate minor drainages. Western wheatgrass, inland saltgrass, and alkali sacaton are conspicuous dominants on bottomlands with finer saline soils.

The occurrence of shrubs and subshrubs also is variable depending upon substrate and topography. Fringed sage, rubber rabbitbrush, broom snakeweed, and winterfat are widely distributed. Fourwing saltbush is common on well-drained alkaline soils. Wax currant and skunkbrush (three-leaf sumac) may occur on rock outcrops.

### 3.0 METHODS

Quantitative methods were used to obtain data on vegetation cover, height, density, and production. Qualitative methods were used for floral surveys, phenological surveys, and evaluations of successional status. Prior to the initiation of field studies, a preliminary vegetation map of the Arsenal was completed. The mapped units were selected on the basis of conspicuous plant associations, or "vegetation types," as described in Section 4.0. Base maps were prepared using air-photo interpretation and field verification. The scale of the air photos was 1:6000 (1 inch = 500 feet). Boundaries between vegetation types were drawn directly on the air photos. The initial vegetation map has been refined as the result of additional field work and changes in vegetation. The vegetation map accompanying this report (Plate I) is the version prepared by MKE for inclusion in the Biota RI report (ESE 1989).

#### 3.1 QUANTITATIVE STUDIES

##### 3.1.1 Site Selection

Vegetation sampling was designed to provide data both for the vegetation studies and to support concurrent wildlife and soils studies. At the RMA, the original sampling design consisted of 50 locations in each of five major vegetation types and 10 locations in each of seven minor types, for a total of 320. However, it was decided to collocate some of these with the 111 wildlife sampling locations and 90 soil sampling locations. The wildlife sites were selected using a systematic random design along section lines, and were set back 100 m from the nearest road. The soil sites were located systematically along radial arms extending away from basins A and F. The distribution of the wildlife and soil sites necessitated additional vegetation sampling in some types to achieve a more balanced design. The additional vegetation sites were selected using pairs of random

umbers as Cartesian (x,y) coordinates. Grid size of the map coordinates was 1 ha (100 m x 100 m).

In an effort to evaluate contamination effects, 24 sampling locations were distributed among three vegetation types in Section 36 (around Basin A), with 16 locations among the same three vegetation types in Section 26 (around Basin F). In all, 424 sites were sampled at RMA. Offsite sampling consisted of 121 locations in two major and two minor types at Buckley, and 113 locations in two major and one minor type at PCC (Table 3-1).

### 3.1.2 Cover, Height, and Woody Plant Density

Cover was estimated along two 50-m transects at each sampling location in the major vegetation types and along one 50-m transect per location in the minor types. Sampling within major types extended from June through September. To avoid seasonal bias, sampling was conducted concurrently at RMA, Buckley, and PCC. Cover sampling used a modification of the point-intercept method described by Mueller-Dombois and Ellenberg (1974). Data collected included vegetation cover (total and by individual species), cover by litter, and amount of bare soil. These three estimates add to 100 percent. Litter consists of dead vegetation, usually the remains of previous growing seasons. Frequency of occurrence (number of locations at which encountered, divided by total number of locations) was estimated for each species within a type.

Height data for dominant species were obtained at 10-m intervals along the paired 50-m cover transects. A maximum of four species were measured at each sampling location. The ten height measurements were averaged by species for each location and vegetation type.

Densities of woody plants (shrubs) and succulents (cacti and yucca) were estimated by counting the number of individuals

Table 3-1.

Number of Quantitative Sampling Sites Per  
Major and Minor Vegetation Type at RMA, Buckley, and PCC

Map Unit	Number of Locations <sup>1</sup>		
	RMA	Buckley	PCC
Weedy Forb	69	10	--
Cheatgrass/Weedy Forb	84	--	--
Cheatgrass/Perennial Grass	75	--	--
Native Perennial Grass	73	51	103
Crested Wheatgrass	50	49	--
Minor Types <sup>2</sup>	73	11	10
 TOTAL	 424	 121	 113

<sup>1</sup> Hyphens indicate that the type was not present at sufficient size for quantitative sampling.

<sup>2</sup> Minor vegetation types sampled at RMA included sand sagebrush, rubber rabbitbrush, yucca, locust thicket, cottonwood-willow, bottomland meadow, and cattail marsh. Only bottomland meadow was sampled at Buckley and PCC.

within 1 m of each 50-m transect. Data from the individual transects were combined to obtain a mean density for each vegetation type.

### 3.1.3 Production

Production of herbaceous species was estimated by clipping all of the current year's above-ground growth within a 1-m<sup>2</sup> quadrat. Clipped samples were oven-dried at 100°C for 24 hours, then weighed to the nearest 0.01 gram. Total production and the percent contributed by each species were computed for each location and vegetation type. Minor vegetation types were not sampled unless the location coincided with a wildlife study site.

Because of cattle grazing at PCC, range cages were used to protect the sample plots. A few cages were destroyed by the cattle; at these locations, the nearest apparently ungrazed site was clipped. To estimate the extent of grazing, ten paired plots (inside versus outside of intact range cages) were sampled in each major vegetation type. Estimates of the percent of production removed by cattle (i.e., "percent utilization") were obtained by comparing the paired values. It should be noted that prairie dogs could enter through the mesh of a range cage and in some cases grazed a portion of the current year's growth.

## 3.2 QUALITATIVE STUDIES

### 3.2.1 Floral Surveys

Separate species lists were prepared for RMA, Buckley, and PCC. Voucher specimens were collected primarily in 1986; specimens were also collected in subsequent growing seasons (through 1989) as additional species were encountered. Voucher specimens were placed in plastic bags at the time of collection, placed into a plant press at the end of the day, and subsequently mounted on herbarium paper.

### 3.2.2 Phenological Surveys

Information on phenology (i.e., the timing of flowering, fruiting, seed dissemination, senescence, and regrowth) was recorded at 10-day intervals during the height of the growing season and at 15-day intervals thereafter. Observations were terminated by snowfall on October 31, 1986. Approximately 47 graminoid species, 96 forb species, and 15 woody species were assessed on each observation day.

### 3.2.3 Evaluation of Successional Status

Black-and-white aerial photographs of RMA taken in 1937, 1943, 1951, and 1974 were reviewed to aid in the evaluation of successional status. In addition, vegetation at the Arsenal was compared with successional stages reported in the literature for other areas of the Great Plains.



## 4.0 RESULTS AND DISCUSSION

The following subsections briefly describe the major and minor plant communities at RMA, Buckley, and PCC. Discussions focus upon composition and structure, location and areal extent, and ecological relationships. Quantitative data are summarized in Table 4-1. A species list is provided in Appendix A, at the back of this volume. Data summaries for each vegetation type are presented in Appendix B (Volume 2). Data for the individual sampling locations are provided in Appendix C (Volume 3).

Nomenclature in this report generally follows Weber (1976), which was the most widely used standard reference for the Front Range area at the time of the study. For recent taxonomic revisions, see Whittmann, Weber, and Johnston (1989) and the supplement to Appendix A.

### 4.1 ROCKY MOUNTAIN ARSENAL

The vegetation map for the Arsenal (Plate I) shows the distribution of five major vegetation types, seven minor vegetation types, industrial areas, and areas of open water. The five major types are classified as weedy forb, cheatgrass/weedy forb, cheatgrass/perennial grass, native perennial grassland, and crested wheatgrass. The seven minor types include yucca grassland, sand sagebrush, rubber rabbitbrush, locust thickets, wetland/riparian, annual rye, and ornamental plantings of trees, shrubs, and lawns.

#### 4.1.1 Weedy Forb Type

Weedy forb communities covered 880 ha (13 percent of RMA) and were most prevalent in the northern two-thirds of the Arsenal. This type was strongly dominated by non-native annual or biennial weeds, plus field bindweed (Convolvulus arvensis, a non-native perennial forb). In prairie dog towns, vegetation was sparse and cropped close to the ground. Vegetation cover in

Table 4-1

Summary of Mean Values for Major Vegetation Types at Rocky Mountain Arsenal (RMA),  
Plains Conservation Center (PCC), and Buckley Air National Guard Base (Buckley).

Location/Vegetation Type	Total Vegetation Cover (%)	Total Production (g/m <sup>2</sup> )	Woody Plant Densit (no./hectare)	No. of Species/ Transect
<b>RMA/</b>				
weedy forb (49)	29.6 ± 17.8	121.0 ± 94.1	334 ± 1,463	4.0
cheatgrass-weedy forb (72)	45.8 ± 14.8	140.3 ± 98.2	249 ± 990	4.8
cheatgrass-perennial grass (67)	40.3 ± 11.6	104.2 ± 63.9	165 ± 457	5.6
native perennial grass (73)	34.5 ± 12.0	96.7 ± 43.9	603 ± 1,504	6.4
crested wheatgrass (50)	28.5 ± 6.7	99.7 ± 38.8	126 ± 292	6.8
<b>PCC/</b>				
mixed grass prairie (51)	69.9 ± 10.5	110.4 ± 34.5	2,079 ± 3,607	7.3
short grass prairie (52)	63.9 ± 15.3	93.1 ± 47.1	14,155 ± 8,667	9.7
<b>Buckley/</b>				
mixed grass prairie (51)	47.0 ± 15.5	77.9 ± 35.9	2,139 ± 3,187	8.3
crested wheatgrass (49)	44.8 ± 16.1	107.7 ± 36.1	525 ± 1,206	5.7

<sup>1</sup> Data collected in 1986; +/- values equal the standard deviation.

<sup>2</sup> Number of transects shown in parentheses.

this type was 30 percent; bare soil was 22 percent. Cover by litter (48 percent) consisted of standing dead annual or biennial plants from previous years. Species diversity was relatively low, with a mean of 4.0 species "hit" along the point-intercept transects. In all, 111 species (38 percent of the flora at RMA) were observed in this type.

The most abundant species in the weedy forb type was summer-cypress (Kochia iranica), followed by field bindweed. Together, these species accounted for nearly half of the total plant cover. Summer-cypress tended to dominate sites without prairie dogs, while field bindweed was more prevalent in prairie dog towns. Other common introduced weeds included cheatgrass (Bromus tectorum), prickly lettuce (Lactuca serriola), tansy-mustard (Descurainia richardsonii, D. pinnata, and D. sophia), tall tumble-mustard (Sisymbrium altissimum), and Russian-thistle (Salsola iberica). The most common native forbs in this type were scarlet globemallow (Sphaeralcea coccinea), annual sunflower (Helianthus annuus), small-flowered gaura (Gaura parviflora), and great mullein (Verbascum thapsis).

Perennial grasses (mostly red three-awn, Aristida longiseta) accounted for 6 percent of the vegetation cover in this type, compared to 54 percent for annual and biennial forbs, 24 percent for perennial forbs, and 16 percent for annual grasses (mostly cheatgrass).

Heights of dominant species were variable. The tallest species were usually small-flowered gaura (93 cm), tall tumble-mustard (69 cm), and annual sunflower (62 cm). These are coarse annuals that are difficult for prairie dogs to graze. Summer-cypress had a mean height of 19 cm, ranging from less than 10 cm in prairie dog towns to over 75 cm in other areas.

Woody plants and succulents were a minor component of the weedy forb type. Combined mean cover was less than one percent, and

mean density was only 334 individuals per ha. Bushy eriogonum (Eriogonum effusum) accounted for 81 percent.

Mean production in the weedy forb type was 121 g/m<sup>2</sup>. Species contributing the most biomass were summer-cypress, field bindweed, prickly lettuce, scarlet globemallow, and cheatgrass. Annual and biennial forbs accounted for 69 percent of the production, perennial forbs 23 percent, annual grasses 5 percent, and perennial grasses 3 percent. The variability of this type is exemplified by the ranges of production for the major species: 0-371 g/m<sup>2</sup> for summer-cypress, 0-268 g/m<sup>2</sup> for field bindweed, and 0-240 g/m<sup>2</sup> for cheatgrass.

Weedy forb communities occur as a result of disturbance and represent an early stage of secondary succession. In Great Plains sites not subject to continued disturbance, weedy forbs are gradually replaced by perennial forbs and perennial grasses (Costello 1944). Prairie dogs may prolong the dominance of weedy forbs by selectively grazing perennial grasses and continually disturbing the soil. Prairie dogs also selectively graze cheatgrass and effectively eliminate it from the area of their towns.

#### 4.1.2 Cheatgrass/Weedy Forb Type

This was the most extensive vegetation type at RMA, covering 1,520 ha (22 percent). The largest stands were in abandoned TX (wheat rust) test sites in Sections 23 and 24 in the northern part of the Arsenal. Vegetation cover in the cheatgrass/weedy forb type was 46 percent, and bare soil was 5 percent. Species diversity (4.8 species per transect) was somewhat higher than that measured for the weedy forb type. A total of 126 species (40 percent of the flora at RMA) were observed in this type.

Cheatgrass was strongly dominant, providing 64 percent of the plant cover. Subdominants included three weedy forb species: field bindweed, musk thistle (Carduus nutans ssp. macrolepis),

nd prickly lettuce. Annual, biennial, and perennial forbs together provided 28 percent of the plant cover, while perennial grasses accounted for 6 percent. The most common perennial grass was sand dropseed (Sporobolus cryptandrus).

The tallest species encountered in the stands included tall gaura (88 cm), musk thistle (84 cm), tall tumble-mustard (74 cm), and prickly lettuce (54 cm). Cheatgrass had a mean height of 31 cm.

Woody plants and succulents were rarely encountered in the cheatgrass/weedy forb type. Mean density was 249 individuals per ha; bushy eriogonum accounted for 72 percent.

The dominance by cheatgrass was also apparent in the production data. Mean production by cheatgrass was 70 g/m<sup>2</sup>, which was 50 percent of the total. Annual and biennial forbs contributed 23 percent of the production, perennial forbs 19 percent, and perennial grasses 7 percent.

Like the weedy forb type, cheatgrass/weedy forb communities represent an early successional stage resulting from disturbance. It appears that disturbed areas remaining since the establishment of the Arsenal tended to be dominated by forbs, while more recently disturbed areas such as the TX fields were dominated by cheatgrass. This probably reflects the dramatic increase in cheatgrass abundance throughout the region over the past few decades. It also is likely that the use of broadleaf herbicides in parts of the Arsenal (ESE 1989) reduced the number of forbs and thus encouraged the invasion of cheatgrass.

Cheatgrass may also prolong the dominance of weedy forbs by outcompeting the perennial grasses. Cheatgrass can germinate in either the fall or late winter; in early spring, it grows vigorously and depletes soil moisture that would otherwise be available for native perennial species. Furthermore, cheatgrass

is an annual grass that dies early in the growing season, thereby increasing the fuel for summer wildfires. Fires during the period when perennial grasses are actively growing may cause them to be stressed or killed.

#### 4.1.3 Cheatgrass/Perennial Grass Type

Although this vegetation type was widespread at the Arsenal, it was the least extensive of the major units, covering 772 ha (11 percent). Vegetation cover was 40 percent, and bare soil was 4 percent. Mean diversity was 5.6 species per transect; 115 species (37 percent of the total at RMA) were observed. Most of these also occurred in the cheatgrass/weedy forb type.

Cheatgrass was dominant, with 58 percent of the plant cover. Subdominants included three perennial grasses: sand dropseed, red three-awn, and needle-and-thread (Stipa comata). Perennial grasses accounted for 28 percent of the vegetation cover, annual and biennial forbs 5 percent, and perennial forbs (mostly field bindweed) 9 percent.

Heights of plants were similar to the cheatgrass/weedy forb type. The tallest species were annual or biennial forbs such as musk thistle, tall gaura, and tansy-mustard, with heights of 81, 77, and 88 cm, respectively. Mean height of cheatgrass was 27 cm.

Few woody plants or succulents were present in this type; density was 165 individuals per ha. The most common species were bushy eriogonum, prickly pear cactus (Opuntia polyacantha), and yucca (Yucca glauca).

Cheatgrass had the highest production, contributing 40 percent of the total of 104 g/m<sup>2</sup>. Perennial grasses accounted for 34 percent of the total, annual or biennial forbs 12 percent, and perennial forbs 13 percent.

Most cheatgrass/perennial grass communities probably represent areas of prairie that were degraded by grazing or other disturbance. Such stands differ from the weedy forb and cheatgrass/weedy forb types in that the pre-existing vegetation has not been completely removed. In other cases, this type may represent succession from weedy forb or cheatgrass/weedy forb communities. That is, mid-successional native grasses may have established in some areas of early successional weeds.

#### 4.1.4 Native Perennial Grassland

Communities dominated by native perennial grasses occurred throughout RMA in a mosaic with other vegetation types. Stands of native grassland ranged in size from less than a few hundred square meters to nearly entire sections. Total area covered by this type was about 1,384 ha (20 percent).

Although treated as a single mapping unit, native perennial grass communities were quite variable because of differences in soil and the amount of prior disturbance (e.g., extent of grazing). Loamy upland soils in northern and west-central areas were generally dominated by blue grama (Bouteloua gracilis), commonly in association with buffalo grass (Buchloe dactyloides). The most extensive of these stands were in sections 4, 33, and 28. Islands of coarser soil in these areas typically supported needle-and-thread, sand dropseed, or red three-awn. Switchgrass (Panicum virgatum) and yellow Indiangrass (Sorghastrum avenaceum) were minor constituents.

Western wheatgrass (Agropyron smithii) was the dominant species on finer soils of the gently rolling uplands in east-central and northeastern areas. Circular patches of this rhizomatous species were frequently interspersed throughout other plant communities, especially in shallow depressions.

Stands of native grasses on sandy soils across southern parts of RMA were usually dominated by sand dropseed or needle-and-

bread, although prairie sandreed (Calamovilfa longifolia), sand bluestem (Andropogon hallii), and Indian ricegrass (Oryzopsis hymenoides) were conspicuous in some sites. These "sand prairie" communities overlapped broadly with sand sagebrush communities, described below. The best stands were in Section 4 near the western boundary and in Section 8 near First Creek. Red three-awn was often common in the understory.

Small areas of cobbly uplands such as Rattlesnake Hill, Henderson Hill, and "North Plants Hill" supported small stands of side-oats grama (Bouteloua curtipendula), ring muhly (Muhlenbergia torreyi), and Sandberg bluegrass (Poa secunda). Low ridges with shallow, sandy soils typically graded into yucca grassland, described later.

Moist bottomlands along First Creek generally supported stands of western wheatgrass, slender wheatgrass (Agropyron trachycaulum), and Canada wildrye (Elymus canadensis). These areas tended to be very weedy, probably because of previous heavy use by cattle. Prevalent weedy species included Canada thistle (Cirsium arvense) and tall marsh-elder (Iva xanthifolia).

Vegetation cover in native grass communities averaged 35 percent, with bare soil at 9 percent. Mean diversity was 6.8 species per transect, the highest of any of the major types at the Arsenal. In all, 161 species were observed in the native perennial grass type; this represented 55 percent of the total at RMA.

Native perennial grasses provided 57 percent of the plant cover in this type. Another 20 percent was provided by cheatgrass, reflecting the prior degradation (overgrazing) of most stands. The tallest species measured was tall tumble-mustard, with a height of 64 cm. Heights of dominant grasses ranged from 15 to 45 cm.



Density of woody plants and succulents was 603 individuals per ha. Prickly pear cactus accounted for 56 percent of total density, and bushy eriogonum 26 percent.

Perennial grasses contributed 61 percent of total production, which was 97 g/m<sup>2</sup>. Perennial forbs contributed an additional 15 percent, annual grasses 14 percent, and annual or biennial forbs 10 percent.

Stands of native perennial grassland at RMA represent remnants of the original prairie. Some locations may have escaped the plow because of unsuitable substrates. Other native stands may have persisted merely because the prior land owner was a rancher rather than a farmer. Sand prairie relicts tended to be in the best condition, probably because cattle generally avoid sandier substrates if forage is available in other areas. Prairie dogs also do not normally occur in sandy areas.

#### 4.1.5 Crested Wheatgrass Type

Monocultures of crested wheatgrass (Agropyron desertorum and A. cristatum) occurred throughout the Arsenal and covered approximately 1,316 ha (19 percent). Aerial photographs indicate that some sites were seeded after the Arsenal was established, while other areas were seeded prior to that time. Crested wheatgrass is a Eurasian species widely used in the region for erosion control.

Vegetation cover in this type was 29 percent; bare soil was 5 percent. Crested wheatgrass provided 72 percent of the vegetation cover. Subdominants included cheatgrass, sand dropseed, and field bindweed, which together contributed 20 percent. Diversity was low, with a mean of only 3.6 species per transect. In all, 101 species (35 percent of the total at RMA) were observed in this type. Mean height of this type was 42 cm;

ecause of the prevalence of a single species, heights were very uniform.

Woody plants and succulents occurred to a limited extent in the crested wheatgrass, with a mean density of only 126 individuals per ha. Yucca and prickly pear cactus were the most common species. One stand contained a single individual of big sagebrush (Artemisia tridentata)--the only individual of that species observed at the Arsenal.

Production of crested wheatgrass was 83 g/m<sup>2</sup>, out of a total of 100 g/m<sup>2</sup>. In none of the other types at RMA did one species contribute so much of the total. The remaining biomass was distributed among 27 species.

Crested wheatgrass areas tend to be relatively stable for many decades. Generally, however, the species eventually declines and is replaced by native perennial grasses. At the Arsenal, some crested wheatgrass stands, especially those on sandy soils, contained a much more conspicuous component of native perennial forbs than other stands. These stands probably represent older plantings in the early stages of senescence.

#### 4.1.6 Sand Sagebrush Type

Communities dominated by native grasses plus sand sagebrush (Artemisia filifolia) occurred on sandy uplands in the southern half of the Arsenal. The total area covered by this type was approximately 100 ha (1.5 percent). Vegetation cover was 71 percent; bare soil was 0.8 percent. Number of species averaged 4.7 per transect. Sixty species (19 percent of the total at RMA) were observed in the sand sagebrush type.

Sand sagebrush provided 39 percent of the plant cover in this type. Dominant species in the herbaceous layer included cheatgrass and needle-and-thread, which together accounted for

2 percent of the total. Prairie sandreed was fairly common; less so was sand bluestem.

Mean height of sand sagebrush was 66 cm. Heights of dominant grasses ranged from 30 to 49 cm. Shrub density was 7,016 individuals per ha, with 89 percent being sand sagebrush. The high shrub density is unusual for prairie upland areas in the vicinity. Sand sagebrush is much more common to the south of RMA in the Arkansas River drainage. Farther north and west, big sagebrush is an important component of the prairie.

At RMA, stands of sand sagebrush probably remained unplowed because of the density of the shrubs as well as the sandy substrate. Most sand sagebrush stands at RMA appear to have been grazed, based on the abundance of cheatgrass and the spotty occurrence of native grasses such as sand bluestem and prairie sandreed. Some stands of sand sagebrush appeared to be expanding into adjacent communities.

#### 4.1.7 Rubber Rabbitbrush Type

Rubber rabbitbrush (Chrysothamnus nauseosus) occurred as widely scattered stands on upland knolls in eastern and southwestern parts of the Arsenal and covered about 23 ha (0.3 percent). Understory vegetation was very similar to the cheatgrass/perennial grass type.

Species diversity was higher than in most types on the Arsenal, with a mean of 6.3 species per transect. A total of 53 species (17 percent of the flora at RMA) were observed in the type. Vegetation cover was 74 percent; bare soil was 0.4 percent. Rubber rabbitbrush provided 25 percent of the plant cover in this type. Major herbaceous species included cheatgrass, sand dropseed, red three-awn, and musk thistle, which together contributed 59 percent of the total.

tands of rubber rabbitbrush were taller than stands of sand sagebrush; mean heights were 117 cm and 66 cm, respectively. Heights of dominant grasses ranged from 44 to 46 cm. Shrub density was 2,550 individuals per ha, primarily rubber rabbitbrush.

The presence in the understory of cheatgrass, mid-successional perennial grasses, and musk thistle suggests that this vegetation type became established as a result of disturbance, such as overgrazing. Once established, rabbitbrush may persist into late successional stages, especially where substrates are suitable (i.e., silty, well-drained soils).

#### 4.1.8 Yucca Grassland

Grasslands with a major component of yucca (soapweed or Spanish bayonet) occurred in the northwestern and south-central areas of the Arsenal. Mean diversity was 6.2 species per transect. A total of 51 species (16 percent of the flora at RMA) were observed in this type. Most species encountered were also common in cheatgrass/perennial grass and native perennial grassland communities.

Vegetation cover was 69 percent; bare soil was 4 percent. Yucca was highly dominant, providing 32 percent of the vegetation cover. Secondary species were cheatgrass, needle-and-thread, red three-awn, sand dropseed, and blue grama. Cheatgrass provided 13 percent of the plant cover, while the four dominant perennial grasses combined for 58 percent.

Heights of dominant herbaceous plants in yucca grassland were similar to those measured in other types, ranging from 20 to 36 cm. The mean height of yucca was 57 cm. Yucca contributed 89 percent of the total density of woody plants and succulents (9,680 individuals per ha).

n the RMA, yucca was best developed on low ridges where soil was sandy but shallow. Such areas generally represent remnants of unplowed prairie because they are unsuitable for farming.

#### 4.1.9 Locust Thickets

Thickets of New Mexico locust (Robinia neomexicana) occupied about 36 ha (0.5 percent) at the RMA, primarily in southern sections. The stands were characterized by having the tallest individuals in the centers. This results because the species spreads by root sprouts radiating away from established plants. New Mexico locust occurs naturally in southern Colorado (Weber 1976) and probably was planted at the Arsenal as a windbreak or for game cover.

Species diversity in this type was very low, with a mean of only 2.5 species per transect. Only 30 species (10 percent of the total at RMA) were observed in the type. The low diversity was due to the dense shade underneath the canopy and competition with the locust trees for moisture. Vegetation cover was 88 percent, and there was no bare soil. Cover values were not estimated for larger individuals (i.e., the overstory), but most stands had nearly continuous canopies. Cheatgrass, with 82 percent of the plant cover, was the dominant species in the understory. Locust root sprouts and summer-cypress were secondary dominants.

Almost all of the woody plant density (5,740 individuals per ha) was contributed by New Mexico locust.

#### 4.1.10 Cottonwood-Willow Type

Narrow stands of mature plains cottonwood (Populus deltoides) and peachleaf willow (Salix amygdaloides) occurred along creeks, irrigation ditches, and reservoirs at RMA and covered approximately 67 ha (1.0 percent). These trees were often 90-100 feet tall and frequently provided a closed canopy.

Vegetation cover was 66 percent, with 0.2 percent bare soil. Species diversity was 4.8 species per transect. In all, 37 species (12 percent of the total at RMA) were observed in this type.

The major species in the understory was smooth brome (Bromopsis inermis), an introduced pasture grass, with 41 percent of the plant cover. Subdominants included cheatgrass, slender wheatgrass, Canada wildrye, and Kentucky bluegrass (Poa pratensis), which together provided 48 percent of the plant cover. Heights of grasses in the understory ranged from 61 to 93 cm. Forbs were uncommon. Kentucky bluegrass is a native species in moist sites in the region.

Plains cottonwoods were the most numerous trees in the overstory, with a density of 640 individuals per ha (79 percent of the total). Peachleaf willows had a density of 120 individuals per ha (15 percent). Rocky Mountain juniper (Juniperus scopulorum) was the only other tree species encountered along the transects.

The cottonwood-willow type occurred at RMA prior to settlement but has expanded with the construction of irrigation ditches and the enlargement or construction of impoundments.

#### 4.1.11 Bottomland Meadow Type

The bottomland meadow type occupied approximately 189 ha (2.8 percent), primarily along drainages, irrigation ditches, and reservoirs. Vegetation cover in this type was 89 percent, one of the highest values at RMA. Mean species diversity (8.0 per transect) was the highest of any type sampled at the Arsenal. In all, 64 species (21 percent of the total at RMA) were observed in the bottomland meadows. Many of these were weedy annual, biennial, and perennial forbs.

Species dominance of bottomland meadows was highly variable, except for the nearly ubiquitous presence of Canada thistle which provided 23 percent of the plant cover. Fourteen additional species contributed from 2 to 6 percent cover and together provided 61 percent of the total. The most common of these were barnyard grass (Echinochloa crus-galli), lady's-thumb (Persicaria maculata), horseweed (Conyza canadensis), and prickly lettuce. Showy milkweed (Asclepias speciosa) was locally abundant. The high cover and diversity of this type resulted from the moist soil.

Most of the weedy forbs were tall, ranging from 76 to 103 cm. Heights of grasses ranged from 43 to 72 cm. Coyote willow (Salix exigua) was present at some locations, but no other shrubby species were encountered along the transects. Russian-olive (Eleagnus angustifolia) was occasionally present in the bottomland meadows.

The appearance of the bottomland meadow type at RMA was very different from what would be expected under native conditions. Prior to settlement, bottomland meadows probably consisted of mesic tallgrasses (such as big bluestem, Andropogon gerardi), western and slender wheatgrasses, and native perennial forbs. The presence of non-native weedy species attests to a history of disturbance, principally overgrazing. Dominance by Canada thistle will continue unless it is controlled. This species spreads aggressively by root sprouts and can completely displace native perennial grasses and forbs.

#### 4.1.12 Cattail Marshes

Cattail marshes covered approximately 54 ha (0.8 percent) on the RMA and were widespread along streams, ditches, and the margins of ponds and reservoirs.

Vegetation cover was 90 percent; there was no bare soil. Species diversity was low, with a mean of only 2.2 species per

ransect. In all, 35 species (12 percent of the total at RMA) were observed in the type. Major species were broadleaf cattail (Typha latifolia, 50 percent cover) and narrowleaf cattail (Typha angustifolia, 32 percent cover). The average height of cattails (both species combined) was 175 cm. No woody plants or succulents were encountered along the transects

Cattails probably were present on the RMA prior to settlement and increased with the development of water projects.

#### 4.1.13 Ornamental Trees and Shrubs

Scattered plantings of ornamental trees and shrubs occurred throughout the Arsenal, but primarily in the southern half. Some were originally planted as windbreaks or for shade near farm and ranch buildings. Others were planted later near Arsenal facilities. The most common trees were green ash (Fraxinus pennsylvanica), Siberian elm (Ulmus pumila), and American elm (U. americana). Less widespread but locally conspicuous species included Russian-olive, black locust (Robinia pseudo-acacia), European white poplar (Populus alba), ponderosa pine (Pinus ponderosa), blue spruce (Picea pungens), and Rocky Mountain juniper. Remnants near farmsteads included fruit trees, lilacs, irises, and old roses such as "Harrison's yellow", all of which were brought across the prairie by settlers.

#### 4.1.14 Native Wildflowers

Native wildflowers did not compose a large percentage of total vegetation cover or production in any of the plant communities at Rocky Mountain Arsenal. Nonetheless, wildflowers were conspicuous, especially in areas that were relatively undisturbed. These species dramatically enhanced the color and visual diversity of the RMA landscape from early spring through fall.



In spring, the first natives to bloom were on the cobbly soils along the south slope of Rattlesnake and Henderson hills. These included sand lily (Leucocrinum montanum), yellow violet (Viola nuttallii), milk vetch (Astragalus missouriensis), and salt-and-pepper (Lomatium orientale).

As temperatures continued to warm, wildflowers of sandy soils began to show their colors. White and narrowleaf beardtongue (Penstemon albidus and P. angustifolius), larkspur (Delphinium virescens), spiderwort (Tradescantia occidentalis), and death camas (Zygadenus venenosus) were most often associated with stands of sand sagebrush, especially in southeastern Section 2. Golden smoke (Corydalis aurea) also occurred with sand sagebrush but appeared to be restricted to the southern border of Section 8. Sand verbena (Abronia fragrans) and white stemless evening-primrose (Oenothera caespitosa) were widespread on sandy soils in the spring. Three other spring flowers--western wallflower (Erysimum asperum), three-tooth groundsel (Senecio tidenticulatus), and scarlet globemallow--were most obvious in prairie dog towns.

Two native biennial thistles bloomed in the early summer. These were hoary thistle (Cirsium canescens) with white flowers and wavyleaf thistle (C. undulatum) with lavender flowers. Both were found on loamy soils. Two ground-cover species, pussytoes (Antennaria rosea) and fog fruit (Phyla cuneifolia), were also found on loamy soils and bloomed during early summer.

Prickly poppy (Argemone polyanthemus) and silvery lupine (Lupinus argenteus) were conspicuous on sandy soils from early summer well into fall, where soil moisture was sufficient. Cutleaf evening-primrose (Oenothera coronopifolia), nearly ubiquitous at RMA, also produced flowers over most of the growing season.

As summer continued, two species of prairie coneflower (Ratibida columnifera and R. tagetes) and bush morning-glory (Ipomoea

leptophylla) added splashes of color to the vegetation in sandy sites. Native wild gourd (Cucurbita foetidissima) produced dense vines with large, whitish leaves and yellow blossoms. Less obvious but common throughout the grasslands was slimflower scurfpea (Psoralea tenuiflora).

Disturbed sites and roadsides also supported native wildflowers during the summer. Annual sunflowers (Helianthus annuus and H. petiolaris), hairy golden-aster (Heterotheca villosa), curlycup gumweed (Grindelia squarrosa), and cow-pen daisy (Verbesina encelioides) added conspicuous yellow color to these areas. Wetland areas supported water speedwell (Veronica anagallis-aquatica), water-cress (Nasturtium officinale), beggar's-tick (Bidens fondosa), and arrowhead (Sagittaria cuneata).

In late summer and fall, color was provided not only by the leaves changing, but also by numerous natives that bloom during this season. These included Rocky Mountain bee-plant (Cleome serrulata), blazing star (Liatris punctata), and silvery tansy-aster (Machaeranthera canescens), all with lavender flowers. Annual buckwheat (Eriogonum annuum), evening star (Mentzelia nuda), and broom butterweed (Senecio spartioides) were also widespread and provided speckles of white and yellow on the landscape. A native tumbleweed, Cyloloma atriplicifolium, formed conspicuous maroon globes on disturbed sandy soils during fall. In bottomland areas, several goldenrod species produced large sprays of yellow flowers.

#### 4.2 BUCKLEY AIR NATIONAL GUARD BASE

The vegetation at Buckley included two major types (mixed grass prairie and crested wheatgrass) and two minor types (weedy forb and bottomland meadow), described below. Vegetation of the other offsite comparison area (the Plains conservation Center, immediately south of Buckley) is described in Section 4.3.

### .2.1 Mixed Grass Prairie

The mixed grass prairie at Buckley occurred primarily on upland areas. The most common species was western wheatgrass, which provided 35 percent of the plant cover in this type. Subdominant perennial grasses were red three-awn, blue grama, and buffalo grass, which together contributed 28 percent of the total. Associated perennial grasses included needle-and-thread, thickspike wheatgrass (Agropyron dasystachyum), prairie junegrass (Koeleria macrantha), and green needlegrass (Stipa viridula). Native perennial grasses accounted for 65 percent of the vegetation cover, perennial forbs 11 percent, and annual grasses 15 percent. The latter included both cheatgrass and Japanese brome (Bromus japonicus). Scarlet globemallow was the most common perennial forb. Annual or biennial forbs were a minor component. Fringed sage (Artemisia frigida), a subshrub, was fairly common with a frequency of 33 percent.

Aside from the presence of cheatgrass, the structure and composition of this type was characteristic of regional native grasslands. Vegetation cover was 47 percent, and bare soil was 6 percent. Species diversity was 8.2 species per transect. In all, 120 species (66 percent of the total) were observed in this type.

Heights of the dominant grasses ranged from 17 to 28 cm; heights of other species ranged from 21 to 43 cm. Density of woody species and succulents was 2,139 individuals per ha, more than 73 percent of which was contributed by prickly pear cactus. In addition were scattered individuals of rubber rabbitbrush, winterfat (Ceratoides lanata), and bushy eriogonum. Rabbitbrush tended to be the tallest species, with a mean height of 37 cm.

Mean production in the mixed grass prairie type was 78 g/m<sup>2</sup>. By far the greatest proportion of the biomass was contributed by western wheatgrass, with 82 percent of the total. Cheatgrass, Japanese brome, red three-awn, and blue grama were also

important. Perennial forbs accounted for 14 percent of the production, and annual or biennial forbs 4 percent.

The mixed grass prairie at Buckley consisted primarily of remnants of the original grassland. The presence of a few weedy non-native species, particularly cheatgrass and Japanese brome, reflects previous livestock use.

#### 4.2.2 Crested Wheatgrass Type

The crested wheatgrass type at Buckley was most common near runways, roads, and buildings, where it presumably had been seeded for erosion control. Vegetation cover was 45 percent, and bare soil 8 percent. In all, 96 species (52.7 percent of the total) were observed in the crested wheatgrass type. Mean species diversity was 5.7 species per transect.

Cover by crested wheatgrass was 22 percent, or 49 percent of the total. Subdominants included western wheatgrass, buffalo grass, Japanese brome, and cheatgrass. These contributed 34 percent of total plant cover. The remainder was provided by 34 other species.

Heights of the dominant grasses ranged from 27 to 37 cm. Yellow sweetclover (Melilotus officinalis) occurred at several locations, with a mean height of 100 cm. Woody plants and succulents were uncommon. Mean density was 525 individuals per ha. Prickly pear cactus accounted for 78 percent of the total.

Mean production in this type was 108 g/m<sup>2</sup>. Crested wheatgrass accounted for 72 percent and western wheatgrass 20 percent of the total. The remainder was distributed among 29 other species.

If left undisturbed, the crested wheatgrass type at Buckley will eventually be replaced by mixed grass prairie. Such replacement could be expected over perhaps 100 years. The successional

process was apparent during the study in that some native prairie species had already become established as subdominants.

#### 4.2.3 Weedy Forb Type

This type occurred at Buckley mainly in prairie dog towns. The dominant species was field bindweed, which accounted for 71 percent of the vegetation cover. Subdominants included cheatgrass, summer-cypress, silvery tansy-aster, and cow-pen daisy. No perennial grasses were encountered along the transects. Vegetation cover was 51 percent; bare soil was 15 percent. Species diversity had a mean of 4.0 species per transect. A total of 39 species (21 percent of the flora at Buckley) were observed in this type.

Heights of dominants ranged from 9 cm for field bindweed to 21 cm for rubber rabbitbrush. Shrubs were very scattered. Density of rubber rabbitbrush, the only shrub encountered, was 200 individuals per hectare. Production was not estimated in this minor type.

#### 4.2.4 Bottomland Meadow Type

Bottomland meadows occurred along ephemeral drainages and reservoirs and are a remnant of pre-settlement vegetation. The major species was western wheatgrass, which provided 70 percent of the plant cover in this type. Subdominants included Kentucky bluegrass, Japanese brome, and prickly lettuce. Vegetation cover was 82 percent; there was no bare soil. Species diversity was 5.2 species per transect. A total of 66 species (36 percent of the flora at Buckley) were observed in this type. Plains cottonwoods and coyote willows occurred in some bottomland meadow sites.

Mean height of western wheatgrass was 46 cm. Heights of other species were not measured. Density of woody plants and cacti was 870 individuals per ha, distributed fairly evenly among

rubber rabbitbrush, winterfat, and prickly pear cactus. Production was not estimated.

#### 4.3 PLAINS CONSERVATION CENTER

Three vegetation types were recognized at PCC: mixed grass prairie, shortgrass prairie, and bottomland meadows. These three types were similar and tended to intergrade. They are remnants of the original prairie, but the presence of some introduced Eurasian weeds (notably cheatgrass and Japanese brome) reflects some disturbance, particularly livestock grazing.

Mixed grass prairie was the most extensive vegetation type at PCC, occurring on most of the upland surfaces. Drier upland sites, particularly slopes, and sites with prairie dogs tended to support shortgrass prairie. Bottomland meadows occurred along drainages.

##### 4.3.1 Mixed Grass Prairie

The major species in the mixed grass prairie type at PCC was western wheatgrass, with 31 percent of the plant cover. Subdominants included sand dropseed, blue grama, needle-and-thread, cheatgrass, Japanese brome, and fringed sage. The remaining cover was distributed among 23 species. Perennial grasses accounted for 61 percent of the plant cover in this type, while forbs accounted for only 2 percent. Native perennial grasses present besides those listed above included sandberg bluegrass, prairie junegrass, and green needlegrass.

Vegetation cover was 60 percent, and bare soil was 0.2 percent. Species diversity was 7.3 species per transect. In all, 127 species (65 percent of the total at PCC) were observed in the mixed grass prairie type. Heights of the dominant species ranged from 15 to 41 cm. Mean heights of shrubs and subshrubs were approximately 20 cm. Low-growing woody plants and

succulents were common in this type with a combined density of 2,079 individuals per ha. Prickly pear cactus accounted for 72 percent of the total.

Production was 114 g/m<sup>2</sup>. The greatest biomass was contributed by western wheatgrass, with 47 percent of the total. Needle-and-thread, sand dropseed, cheatgrass, and Japanese brome were also important. The remaining production was distributed among 44 species. Production by all forbs represented 7 percent of the total. The balance was contributed by annual grasses.

#### 4.3.2 Shortgrass Prairie

Shortgrass prairie occurred throughout the PCC on drier upland sites. Major species included blue grama and western wheatgrass, which together provided 48 percent of the plant cover. Subdominants included buffalo grass, ring muhly, cheatgrass, Japanese brome, and fringed sage. Shortgrass prairie was the only type in which warm-season grasses (blue grama and buffalo grass) provided more cover than cool-season grasses. Forbs were a minor component, contributing only 6 percent of the vegetation cover.

Vegetation cover was 64 percent, and bare soil was 2 percent. Species diversity was 9.7 species per transect, which was the highest of any type in the three study areas. In all, 102 species (52 percent of the total at PCC) were observed in the shortgrass prairie. Most of these also occurred in the mixed grass prairie.

Heights of dominant species in the shortgrass prairie were similar to values for those same species in mixed grass prairie. Density of woody plants and succulents was much higher in the shortgrass prairie than the mixed grass prairie. Mean density was 14,155 individuals per ha. Prickly pear cactus accounted for 72 percent of the total, and rubber rabbitbrush 18 percent. Mean height of rubber rabbitbrush was 20 cm.

Mean production in the shortgrass prairie was 93 g/m<sup>2</sup>. Major contributors included blue grama, western wheatgrass, buffalo grass, cheatgrass, and Japanese brome. These five species accounted for 66 percent of the total. The remainder was distributed among 47 species.

#### 4.3.3 Bottomland Meadow Type

This type occurred along East Toll Gate Creek, an ephemeral drainage crossing the site from south to north. The distinction between the two upland prairie types and the bottomland meadows was most pronounced where the creek crossed the boundary of PCC and entered Buckley.

The dominant species was western wheatgrass, which accounted for 70 percent of the plant cover. Kentucky bluegrass and Japanese brome were secondary grasses, combining for 16 percent of the total. The remaining cover was contributed by sixteen species. Annual or biannual forbs provided slightly more of the plant cover than did perennial forbs (6 vs. 5 percent). Bare soil was 0.2 percent.

Species diversity was 4.7 species per transect, which was lower than either of the upland prairie types at PCC. In all, 84 species (43 percent of the total at PCC) were observed in bottomland meadows. Mean height of the dominant species, western wheatgrass, was 27 cm. Only a few scattered shrubs and cacti occurred; density was only 70 individuals per ha. Production was not estimated.



## 5.0 COMPARISONS OF VEGETATION WITHIN AND AMONG STUDY AREAS

### 5.1 ONSITE-OFFSITE COMPARISONS OF QUANTITATIVE DATA

Statistical comparisons of plant cover, production, density, and diversity were made within the major vegetation types occurring both onsite and offsite (Table 5-1). Differences among study areas were evaluated using one-way analysis of variance. Results of these comparisons are summarized below.

#### 5.1.1 Native Grassland

Cover, production, and density differed significantly ( $P < 0.05$ ) in native grassland among the three study areas. Mean cover in the native perennial grassland at RMA (34.5 percent) was lower than in the mixed grass prairie at PCC (69.9 percent), the shortgrass prairie at PCC (63.9 percent), or the mixed grass prairie at Buckley (47.0 percent). Mean production in native grassland at RMA ( $96.7 \text{ g/m}^2$ ) was lower than the mixed grass prairie at PCC ( $110.4 \text{ g/m}^2$ ) but higher than the shortgrass prairie at PCC ( $93.1 \text{ g/m}^2$ ), or the mixed grass prairie at Buckley ( $77.9 \text{ g/m}^2$ ). There were also significant differences in cover and production between the offsite areas (Table 5-1).

The lower cover in native grasslands at RMA was mostly related to the lower species diversity, particularly the paucity of native forbs and shortgrasses. The fact that production fared better at RMA reflects the presence of tall weedy forbs and the prevalence of taller bunch-grass species. These add considerable biomass in relation to the area they cover.

The total number of species observed in native perennial grassland at RMA (133) was higher than in the shortgrass prairie at PCC (102) and the mixed grass prairie at either PCC (127) or Buckley (120). This probably was due to the larger sample size and greater areal extent at RMA. In contrast, the mean number of species encountered along the cover transects was lower at

Table 5-1

Comparison of Vegetation Types Among Study Areas<sup>1</sup>

Vegetation Type/Study Area <sup>2</sup>	Mean			Total Species
	Cover (%)	Production (g/m <sup>2</sup> )	Density (no./ha)	Species Per Transect
Native Grassland, RMA (n=73)	34.5 <sup>a</sup>	96.7 <sup>c</sup>	603 <sup>a</sup>	6.8 <sup>a</sup>
Mixed Grass Prairie, Buckley (n=51)	47.0 <sup>b</sup>	77.9 <sup>a</sup>	2,139 <sup>b</sup>	8.3 <sup>c</sup>
Mixed Grass Prairie, PCC (n=51)	66.9 <sup>c</sup>	110.4 <sup>d</sup>	2,079 <sup>b</sup>	7.3 <sup>b</sup>
Shortgrass Prairie, PCC (n=52)	63.9 <sup>c</sup>	91.3 <sup>b</sup>	14,155 <sup>c</sup>	9.7 <sup>d</sup>
Crested Wheatgrass, RMA (n=48)	28.5 <sup>a</sup>	99.7 <sup>a</sup>	1,269 <sup>a</sup>	3.6 <sup>a</sup>
Crested Wheatgrass, Buckley (n=49)	44.8 <sup>b</sup>	107.7 <sup>a</sup>	525 <sup>a</sup>	5.7 <sup>b</sup>
				96

1 Numbers in the same column and analogous vegetation type followed by the same letter are not significantly different ( $p=0.05$ ).

2 n=number of transects.

3 Includes shrubs, yucca, and cacti.

MA (6.8) than in the mixed grass prairie at PCC (7.3) or Buckley (8.3) and the shortgrass prairie at PCC (9.7).

The lower diversity within native grasslands at RMA probably has resulted from the reduction of more palatable species during previous overgrazing. Use of broadleaf herbicides (see ESE 1989) might have been a factor, except that (a) native grasslands were generally located in areas where use of selective herbicides would not be expected, and (b) the lower diversity was reflected in grass species as well as broadleaf (forb) species. Native grassland communities usually were monotypic at RMA--i.e., strongly dominated by one grass species--while conspicuously more heterogeneous offsite.

Native perennial grassland at RMA had significantly fewer woody plants and succulents (603/ha) than the comparable types at either PCC (2,079/ha) or Buckley (2,139/ha). This appeared to be related to substrate, because the few stands in rocky upland sites on RMA had densities similar to the offsite areas, which had similar soils.

#### 5.1.2 Crested Wheatgrass

Differences in cover between crested wheatgrass at RMA and at Buckley (28.5 vs. 44.8 percent, respectively) were statistically significant ( $P < 0.05$ ), while differences in total production (99.7 vs. 107.7 g/m<sup>2</sup>) were not. The larger cover value at Buckley resulted from the increased presence of warm-season shortgrasses, particularly buffalo grass. Such species add considerable cover but provide little production.

The mean number of species observed along cover transects in crested wheatgrass at RMA was significantly lower than at Buckley (3.6 vs. 5.7). Both the greater cover and higher diversity at Buckley reflect the fact that stands of crested wheatgrass offsite were beginning to be invaded by native forbs and grasses. Greater invasion by native species at Buckley has

resulted from the presence of those species in adjacent habitats and the finer mosaic of plant communities. At RMA, many crested wheatgrass stands were adjacent to weedy communities. Even where native species were present in adjacent stands at RMA, the coarser mosaic has kept them remote from all but the edges of the crested wheatgrass communities.

The total number of species observed in crested wheatgrass was slightly higher at RMA than at Buckley (101 vs. 96). As with native grassland, this was due to the greater areal extent and larger sample size of this type at RMA.

## 5.2 ONSITE-OFFSITE COMPARISONS OF QUALITATIVE SURVEYS

Comparisons of phenology revealed no appreciable differences between RMA and the two offsite areas. Dates of fruiting and flowering were affected primarily by environmental factors. Maturation was typically delayed in areas having greater soil moisture or limited competition, and in areas grazed by prairie dogs. Results of the phenological survey are summarized in Table 5-2. Dates apply to both the onsite and offsite areas.

Floristic comparisons showed only slight differences among study areas (Table 5-3). Native perennial grasses contributed similar percentages of the total flora at the three sites. Native forbs, shrubs, subshrubs, and cacti were generally more prevalent at Buckley and PCC, while sedges, yucca, and introduced forbs were more prevalent at RMA. As described previously, the total number of species observed was greater at RMA, owing to its greater size, more varied substrates, and presence of a greater number of non-native weedy or ornamental species.

Table 5-2.

## Phenology of Selected Species at BMA, Buckley, and PCC

	OBSERVATION DATES			
	6/6	6/20	7/3	7/31
WESTERN WHEATGRASS (COOL-SEASON GRASS)	Early Inflorescence Development	Early Flowering	Flowering	Early Seed Development
SAND DROPSEED (WARM-SEASON GRASS)	Vegetative Growth	Vegetative Growth	Vegetative Growth	Inflorescence De- velopment in Sheath
BLUE GRAMA (WARM-SEASON GRASS)	Vegetative Growth	Vegetative Growth	Vegetative Growth	Seed Development
CHEATGRASS (ANNUAL GRASS)	Seed Development	Seed Maturation	Mature Seed	Vegetative Growth
WOOLLY PLANTAIN (ANNUAL FORB)	Flowering	Flowering	Seed Development	Seed Dissemip-ation
HAIRY GOLDEN-ASTER (PERENNIAL FORB)	Early Flowering	Flowering	Full-Bloom Flowering	Mature Seed
WESTERN RAGWEED (PERENNIAL FORB)	Vegetative Growth	Vegetative Growth	Vegetative Growth	Seed Development
EVENING PRIMROSE (PERENNIAL FORB)	Flowering	Flowering	Early Seed Development	Inflorescence Development
SLIMFLOWER SCURFPEA (PERENNIAL FORB)	Vegetative Growth	Vegetative Growth	Early Inflorescence Development	Early Flowering
FRINGED SAGEBRUSH (SUB-SHRUB)	Vegetative Growth	Vegetative Growth	Vegetative Growth	Seed Maturation
SAND SAGEBRUSH (SHRUB)	Vegetative Growth	Vegetative Growth	Vegetative Growth	Early Seed Development
				Inflorescence Development
				Early Inflorescence Development
				Early Flowering

Table 5-2.  
(Continued)

	8/14	8/28	9/12	10/1	10/16	10/31
	Seed Maturation	Seed Dissemination	Seed Dissemination	Vegetative Growth	Vegetative Growth	Vegetative Growth
WESTERN WHEATGRASS (COOL-SEASON GRASS)	Seed Maturation	Seed Dissemination	Seed Dissemination	Vegetative Growth	Vegetative Growth	Vegetative Growth
SAND DROPSEED (WARM-SEASON GRASS)	Seed Development	Seed Development	Seed Maturation	Seed Dissemination	Seed Mostly Disseminated	Dormancy
BLUE GRAMA (WARM-SEASON GRASS)	Early Flowering	Flowering	Flowering	Seed Maturation	Seed Maturation	Seed Maturation
CHEATGRASS (ANNUAL GRASS)	Seed Dissemination	Seed Mostly Disseminated	Seed Mostly Disseminated	Seedlings Begin Growth	Seedling Growth	Seedling Growth
WOOLLY PLANTAIN (ANNUAL FORB)	Seed Dissemination	Seed Dissemination	Seed Maturation Plants Disintegrating	Plants Disintegrating	Plants Disintegrating	Plants Disintegrating
HAIRY GOLDEN-ASTER (PERENNIAL FORB)	Seed Maturation & Dissemination	Seed Maturation & Dissemination	Seed Dissemination	Seed Mostly Disseminated	Seed Mostly Disseminated	Slight Vegetative Growth
WESTERN RAGWEED (PERENNIAL FORB)	Flowering	Flowering	Early Seed Development	Seed Maturation	Seed Maturation	Seed Dissemination
EVENING-PRIMROSE (PERENNIAL FORB)	Seed Dissemination	Seed Dissemination	Seed Mostly Disseminated	Seed Mostly Disseminated	Seed Mostly Disseminated	Seed Mostly Disseminated
SLIMFLOWER SCURFPEA (PERENNIAL FORB)	Early Seed Development	Seed Maturation	Mature Seed	Seed Dissemination	Seed Dissemination	Seed Dissemination
FRINGED SAGEBRUSH (SUB-SHRUB)	Inflorescence Development	Flowering	Early Seed Development	Seed Development	Seed Maturation	Seed Maturation & Dissemination
SAND SAGEBRUSH (SHRUB)	Early Flowering	Flowering	Flowering	Early Seed Development	Seed Development	Seed Maturation & Dissemination

Table 5-3.

Number of Species and Percent of Total Flora Represented by  
the Various Life Forms at RMA, Buckley, and PCC

Life Form	Number of Species			Percent of Total Number of Species at Each Site		
	RMA	BF	PCC	RMA	BF	PCC
Native Perennial Grasses	39	22	21	12	8	9
Introduced Perennial Grasses	14	5	8	4	3	4
Native Annual Grasses	5	3	3	2	2	2
Introduced Annual Grasses	11	7	3	4	3	4
Native Perennial Forbs	98	57	72	31	31	37
Introduced Perennial Forbs	19	8	7	6	4	4
Native Biennial Forbs	6	7	7	2	4	4
Introduced Biennial Forbs	7	5	6	3	3	3
Native Annual Forbs	41	25	26	13	14	13
Introduced Annual Forbs	31	19	22	9	10	11
Native Semi-Shrubs	3	4	3	1	2	1
Native Shrubs	12	7	7	4	4	4
Introduced Shrubs	5	2	1	2	1	1
Native Woody Vines	2	-	-	1	-	-
Native Trees	4	4	2	3	2	1
Introduced Trees	16	3	2	2	3	1
Cacti and Succulents	5	4	3	1	2	2
TOTAL	318	182	195			
All Perennial Grasses	51	27	29	17	15	15
All Annual Grasses	16	10	8	5	6	4
All Forbs	199	121	140	63	67	72
Others	46	24	18	15	13	9

### 5.3 ONSITE COMPARISONS

Comparing plant communities in close proximity to basins A and F (sections 26 and 36) with those from other parts of the Arsenal revealed no statistically significant differences.

A few of the differences appear substantial--for example, differences in cover and production for cheatgrass/perennial grass between Section 26 and Section 36 (Table 5-4). However, small sample sizes ( $n=3$ ,  $n=5$ ) and high variability make the differences nonsignificant. This discrepancy in cover and production is explainable by the ecological situation: Many of the Section 36 sample locations supported prairie dogs, and hence were characterized by low, sparse vegetation, while prairie dogs were absent from all of the Section 26 locations.

As a second approach to comparing areas near basins A and F with the rest of RMA, the ten dominant species in analogous "test" and "control" plots were examined statistically. The ten species, chosen on the basis of "importance value" (relative cover times relative frequency), were red three-awn, sand dropseed, cheatgrass, scarlet globemallow, ground-cherry, skeleton-weed, tansy-mustard, prickly lettuce, musk thistle, and field bindweed. Other species were not present in sufficient numbers for statistical analysis.

Test plots consisted of all vegetation sampling locations within sections 26 and 36 (a total of 40). Control plots for initial investigations consisted of all plots located throughout the RMA exclusive of those in sections 26 and 36 (a total of 199). As described later, final testing involved a balanced statistical design in which data from the 40 test plots were compared with data from 40 randomly selected control plots.

Initial investigations centered on searching for species (among the ten selected) that appeared to differ between control and test plots in terms of cover, frequency, or production. Data



Table 5-4

Comparisons of Cover and Production Estimates on  
RMA for Three Major Plant Communities<sup>1</sup>

<u>Vegetation Type/Location</u>	<u>Mean</u>	
	<u>Cover</u> (%)	<u>Production</u> (g/m <sup>2</sup> )
Weedy Forb		
Section 26 (n=8)	43.4	162.4
Section 36 (n=12)	28.8	124.9
Remainder of RMA (n=49)	29.6	121.0
Cheatgrass/Weedy Forb		
Section 26 (n=5)	50.4	192.6
Section 36 (n=7)	41.0	121.8
Remainder of RMA (n=72)	45.8	140.3
Cheatgrass/Perennial Grass		
Section 26 (n=3)	54.3	229.9
Section 36 (n=5)	32.0	57.3
Remainder of RMA (n=67)	40.3	104.2

<sup>1</sup> No statistically significant differences were found among comparable vegetation types.

were compared for three major vegetation types occurring in both the control and test locations: weedy forb, cheatgrass/weedy forb, and cheatgrass/perennial grass (Table 5-5).

The results shown on Table 5-5 were subjected to a paired sample t-test to determine whether the ten species differed, as a group, between control and test locations. No significant differences were found (all P values were greater than 0.50). However, a visual examination of Table 5-5 suggests a pattern of vegetation response for four species: Field bindweed and musk thistle tended to have lower test plot values, while ground-cherry and scarlet globemallow tended to have lower control plot values. These four species showed a high degree of consistency for cover, frequency, and production across the three vegetation types and were therefore selected for further analysis.

In order to achieve a balanced statistical design, 40 control plots were randomly selected from the initial 199. All plots occurring within a 1-mile zone surrounding section 26 and 36 were eliminated to ensure that control plots were adequately separated from test plots. The remaining plots were then stratified across vegetation types and a random selection was made in the same proportion among types as inside sections 26 and 36 (viz., 20 weedy forb plots, 12 cheatgrass/weedy forb plots, and 8 cheatgrass/perennial grass plots).

Cover data from the three vegetation types were then combined and subjected to an analysis of variance to compare differences between control and test locations. Only cover data were compared because measurements of this variable are more precise; also, the high correlations between cover, frequency, and production would result in redundant analyses. Only field bindweed showed a statistically significant difference in cover between control and test plots ( $P < 0.001$ ) (i.e., it had higher cover in control plots). The other three species did not approach significance (P values were all near 0.50). Although this might suggest that field bindweed is an indicator of

Table 5-5

Comparisons of Cover, Frequency, and Production Between Control and Test Plots  
for the Ten Most Common Plant Species in Three Vegetation Types

Vegetation Type	Red three-awn		Sand dropseed		Cheatgrass		Scarlet globemallow		Ground- cherry		Skelton- Weed		Tansy- mustard		Prickly lettuce		Rus- sult		Field bindweed		
	C		T		C		C		C		C		C		C		C		C		
	T		T		T		T		T		T		T		T		T		T		
COVER (%)																					
WF	1.1	0	0.1	0.4	4.6	0.1	1.3	2.1	0	0.4	0	0	1.2	3.1	1.4	4.3	0.1	0	6.3	0.4	
C/WF	0.4	0.5	1.3	1.2	35.2	2.4	0.4	0.3	0.1	1.3	0.1	0.3	0.1	0.2	0.9	1.3	2.4	0.4	5.5	0.4	
C/PG	1.3	1.0	6.6	3.8	29.1	1.1	0.2	0.3	0.1	0.4	0.4	0.1	0	0	0.3	0.1	1.1	0.1	1.2	0.6	
FREQUENCY (%)																					
WF	9.4	3	1.9	5.0	30.0	5.7	32.1	35.0	1.9	10.0	1.9	0	15.1	25.0	24.5	50.0	5.7	0	49.1	5.0	
C/WF	13.9	16.7	32.9	8.3	100.0	29.1	16.5	33.3	6.3	41.7	2.5	16.7	1.3	8.3	21.5	25.0	29.1	16.7	44.3	16.7	
C/PG	23.4	50.0	70.2	50.0	100.0	23.9	11.9	25.0	6.0	37.5	23.9	12.5	1.5	0	14.9	12.5	23.9	12.5	28.4	37.5	
PRODUCTION (g/m <sup>2</sup> )																					
WF	0.3	0	0.1	2.1	9.6	0	6.9	10.1	0.1	0.7	0.4	0	3.9	5.7	8.7	23.2	0	0	12.6	1.5	
C/WF	0.6	1.3	4.7	2.8	124.7	12.6	1.9	1.4	0.2	1.2	0.9	0.2	0.7	1.1	5.2	3.7	12.6	6.2	6.7	0	
C/PG	2.5	2.7	20.8	5.2	77.8	4.5	1.4	1.5	0	3.4	3.5	1.6	0.2	0.5	2.7	0.3	4.5	0	1.8	0	

1C = Control plots, vegetation study plots on the RMA exclusive of those within sections 26 and 36.

T = Test plots, vegetation study plots located within sections 26 and 36.

WF = Weedy Forb; C/WF = Cheatgrass/Weedy Forb, C/PG = Cheatgrass/Perennial Grass

contamination, such an interpretation should be applied cautiously. Other factors, such as competition with weedy annual or biennial forbs and differences in the percentage of control and test plots that were affected by prairie dogs, could be causative.

#### 5.4 SUMMARY OF COMPARISONS

It can be concluded from the preceding subsections that, for the most part, the vegetation at RMA has been little affected by contamination. Adverse effects at either the species or community level are apparently confined to the disposal basins. It should be noted, however, that the basins have also been affected by factors such as salinity, alkalinity, texture, compaction, and periodic inundation. Therefore, the paucity of vegetation in these areas is unlikely to be solely a result of contamination.

Most of the weedy areas at RMA outside the basins appear to have resulted from the abandonment of plowed fields, previous grazing of livestock, and disturbance by prairie dogs. The use of herbicides and soil sterilants (to prevent wildfires in manufacturing and storage areas, see ESE 1989) and military activities have also contributed to the weediness of the Arsenal.

## 6.0 PLANT COMMUNITIES OF SPECIAL INTEREST

Investigations of the soils, vegetation, and wildlife at Rocky Mountain Arsenal have revealed several plant communities and other specific areas of special interest. These include areas of remnant natural prairie, localized stands of vulnerable plant species, habitats of special importance to wildlife, areas with excellent potential for re-establishing prairie habitat, and landscape features that are unique or of limited occurrence on RMA. A map of these areas was distributed in November 1988 and is provided with this report as Plate II.

Areas of special interest may be divided into three priority classes: (1) highest priority sites that are especially rare or sensitive to disturbance; (2) sites worthy of protection but which are less sensitive or restricted; and (3) sites that are currently degraded but have excellent potential for restoration. The following sections describe the areas of special interest shown on the accompanying map.

### 6.1 HIGHEST PRIORITY AREAS

#### 6.1.1 Sand Prairie Grassland

The most important stand of native grassland at RMA is a 6-ha parcel in southwestern Section 4, east of the trees along Quebec and west of the "L" shape homestead windbreak. This area supports a stand of unplowed sand prairie, which is rare on a regional and statewide basis. The land is dominated by needle-and-thread interspersed with blue grama, but the abundance of sand bluestem, prairie sandreed, and bush morning-glory is what makes the area of special interest.

#### 6.1.2 Shortgrass Prairie Grassland

The best example of shortgrass prairie at RMA covers approximately 80 ha in the northern half of Section 33 east of the

Irondale treatment system. This area is dominated by blue grama interspersed with needle-and-thread and some buffalo grass. It is an important seed source for species associated with shortgrass prairie and is the largest parcel of such habitat for wildlife on the Arsenal.

#### 6.1.3 Sand Sagebrush Shrubland

Several areas of sand sagebrush shrubland occur at RMA. In Section 2, about 15 ha of sand sagebrush occurs south of the South Plants, west of "D" Street, and north of the eastern "neck" of Lake Ladora. This stand has a well developed understory of blue grama, native forbs, and three species of cactus, including ball cactus (Coryphantha vivipara), and hedgehog cactus (Echinocereus viridiflorus). Stands of sand sagebrush in Section 8 cover approximately 70 ha. Some of the stands in Section 8 are rather weedy as a result of overgrazing, but others have a well developed understory of blue grama and sun sedge. Prairie sandreed is scattered throughout, and one site contains considerable numbers of ball cactus. Sand sagebrush shrubland is uncommon in the region.

#### 6.1.4 Gravel Breaks

Several small areas of the Gravel Breaks range site occur on cobbly soils at the Arsenal. The most prominent and least disturbed is an area of about 11 ha in central Section 35 that includes Rattlesnake Hill. A number of plant species observed here were found in no other location on RMA. These include Fendler three-awn (Aristida fendleriana), side-oats grama, Sandberg bluegrass, yellow violet, salt-and-pepper, and broom snakeweed (Gutierrezia sarothrae). These areas are remnants of an ancient South Platte River terrace.

#### 6.1.5 Mature Cottonwoods along First Creek

Trees, regardless of size or species, are important habitat components at the Arsenal. The mature plains cottonwoods along First Creek in Section 5 are especially important as roost sites for bald eagles that winter at RMA and are critical to their occurrence. The cottonwoods also provide nesting habitat for a variety of hawks and other birds and cover for white-tailed deer.

#### 6.1.6 Duckweed Pond

This small pond is located in eastern Section 12 and is relatively remote from any roads. The pond is surrounded by cattails and mature cottonwoods, and is a tranquil setting. In late summer and fall, the pond surface is covered with duckweed (Lemna sp.), a small aquatic plant that does not occur in great abundance in other water bodies at the Arsenal. The pond is frequented by numerous wildlife, and great horned owls and other raptors roost in the cottonwoods.

### 6.2 SECONDARY AREAS

#### 6.2.1 Wetland and Streamside Areas

Wetland and streamside vegetation at RMA includes four basic types: cottonwood/willow stands, marshes, channel areas, and bottomland meadows. All wetland and streamside sites are important components of wildlife habitat at RMA.

- Cottonwood/willow stands occur in various locations, but especially around the lakes, along the southern half of First Creek in sections 8, 5, 6, and 31, and along the ditches in Section 7. A mature stand of peachleaf willows occurs in the southwestern corner of Section 7. This area has a well developed understory of riparian shrubs and grasses.

Marshes occur around the lakes, ponds, ditches, and First Creek. Most of these areas are dominated by cattails. One marsh of about 8 ha is located south of the Toxic Storage Yard Pond along First Creek and is dominated by reed canarygrass (Phalaris arundinaceae). A playa dominated by Baltic rush (Juncus arcticus) occurs in southwestern Section 8.

The bottomland meadows are generally composed of weedy vegetation and are discussed in Section 6.3.1. Channel vegetation is an amalgamation of aquatic, marsh, streamside, and bottomland vegetation. This type occurs along disturbed water courses.

#### 6.2.2 Yucca Stands

Yucca is scattered over the RMA landscape, but two areas are of particular importance. One is a large stand of about 48 ha in portions of sections 27 and 28. The area is an extension of the shortgrass prairie in Section 33 and has a well developed understory of blue grama. A smaller stand of about 10 ha occurs northeast of the RMA South Gate in Section 11. This area also has a good understory of blue grama and other native grasses and contains abundant rubber rabbitbrush. Kangaroo rats are especially prevalent in association with this yucca stand.

#### 6.2.3 Prickly Pear Stands

Prickly pear cactus is also scattered over the Arsenal but are much less common than yucca. One dense stand of prickly pear occurs on the ridge north and east of the pistol range in Section 19. Ring muhly and winterfat are also common at this location. This is the only area on the Arsenal with this particular combination of plants.



### 6.3 DEGRADED AREAS WITH POTENTIAL FOR IMPROVEMENT

#### 6.3.1 Swales and Bottomland Meadows

Swales and bottomland meadows on RMA are currently dominated by weedy vegetation. Prior to disturbance, these areas probably supported mesic tallgrass prairie. Two major swale areas in the western and eastern parts of the Arsenal represent ancient stream channels. Bottomland meadows are more extensive than swales at RMA. Most are located adjacent to First Creek, but they also occur in limited zones around the lakes and ponds.

These low-lying areas receive surface runoff and therefore have thicker and moister soils than the uplands. Native mesic tallgrasses such as big bluestem, switchgrass, and Indiangrass could be re-established in these areas. Mesic tallgrass prairie is limited in the region.

#### 6.3.2 Upland Grasslands

Dry upland soils across RMA undoubtedly supported shortgrass and mixed grass prairie prior to settlement. As described in Section 2.6, this probably appeared as a mosaic because of variation in soils and topography.

Upland prairie communities could be re-established in the weedy forb and cheatgrass/weedy forb communities by removing the existing vegetation and seeding desirable grasses and wildflowers. Such an effort would need to be staged over a period of years to achieve a diverse, self-sustaining cover that would appear natural and withstand grazing by prairie ungulates (e.g., bison, pronghorn, elk).

In areas currently mapped as cheatgrass/perennial grass, the native component is present but minor. Selective herbicides, mowing, controlled burning, and periodic grazing could be used to enhance the native grasses while suppressing the weeds.

Supplemental interseeding might also prove effective in some of these areas.

#### 6.3.3 Species Recommendations

Table 6-1 is a list of trees and shrubs that could be used to enhance or rehabilitate bottomland and upland habitats at RMA. Most of the species either occur naturally in the region or have become naturalized. Table 6-2a lists native grass species which would be appropriate for reseeding and are commercially available. Appropriate native or naturalized forb (wildflower) species are listed in Table 6-2b.

Unfortunately, some native grasses in the region are unavailable commercially. Areas at RMA could be planted with monocultures of desirable grasses to serve as "seed orchards." Other areas could be planted to pasture grasses as a source of hay mulch for use in revegetation. Existing stands of crested wheatgrass could also be mown and baled for hay mulch.

Table 6-1

Woody Plant Species Recommended for Use at RMA

<u>Species</u>	<u>Growth Form</u>	<u>Appropriate Habitat</u>
Fringed Sage	subshrub	uplands
Winterfat	subshrub to low shrub	uplands
Sand Cherry	low shrub	sandy sites
Snowberry	low shrub	shady riparian
Arkansas Rose	low to medium shrub	moist sites
Wax Currant	low to medium shrub	rocks, slopes
Gooseberry Currant	low to medium shrub	shady riparian
Golden Currant	medium shrub	moist sites
Rubber Rabbitbrush	medium shrub	uplands
Fourwing Saltbush	medium shrub	uplands
Sand Sagebrush	medium shrub	sandy sites
Skunkbrush Sumac	medium shrub	rocks, slopes
Mountain Ninebark	medium to tall shrub	moist sites
Redtwig Dogwood	medium to tall shrub	shady riparian
American Plum	medium to tall shrub	moist sites
Chokecherry	tall shrub	moist sites, riparian
Hawthorn	tall shrub	sunny riparian
Silver Buffaloberry	tall shrub	sunny riparian
Elderberry	tall shrub	shady riparian
Nannyberry	tall shrub	shady riparian
Highbush Cranberry	tall shrub	shady riparian
Mountain Maple	tall shrub	shady riparian
Mulberry	tall shrub to small tree	riparian
Gambel's Oak	tall shrub to small tree	moist sites
Mountain-ash	tall shrub to small tree	moist sites
New Mexico Locust	tall shrub to small tree	uplands
Pinyon Pine	small to medium tree	uplands
Rocky Mountain Juniper	small to medium tree	moist sites
Boxelder	medium tree	moist sites, riparian
Hackberry	medium tree	moist sites, riparian
Apple, Crabapple, Cherry	medium tree	moist sites, riparian
Plains Cottonwood	large tree	moist sites, riparian
Narrowleaf Cottonwood	large tree	moist sites, riparian
White Poplar	large tree	moist sites
Peachleaf Willow	large tree	riparian
American Sycamore	large tree	riparian
Green Ash	large tree	moist sites
Silver Maple	large tree	moist sites
Black Locust	large tree	uplands
Honeylocust	large tree	uplands
Ponderosa Pine	large tree	moist sites
White Pine	large tree	moist sites
Blue Spruce	large tree	riparian

Table 6-2a

Native Grass Species Recommended for Use at RMA<sup>1</sup>

<u>Species</u>	<u>Variety</u>	<u>Height</u>	<u>Season</u>	<u>Form</u>	<u>Soil Type</u>	<u>Locations</u>
Blue grama	Lovington	Short	Warm	Sod-former	Loamy/clayey	Upland
Buffalo grass	Sharp's	Short	Warm	Sod-former	Loamy/clayey	Upland
Canada bluegrass	Reubens	Short	Cool	Rhizomatous	Loamy/clayey	All
Canby bluegrass	Native	Short	Cool	Bunchgrass	Loamy	All
Alkali sacaton	Native	Medium	Warm	Bunchgrass	Clayey/Saline	Bottomland
Canada wildrye	Native	Medium	Cool	Bunchgrass	All	Bottomland
Green needlegrass	Lodonn	Medium	Cool	Bunchgrass	Loamy/clayey	All
Indian ricegrass	Nexpar	Medium	Cool	Bunchgrass	Sandy	All
Little bluestem	Pastura	Medium	Warm	Bunchgrass	All	Bottomland
Needle-and-thread	Native	Medium	Cool	Bunchgrass	Sandy	Upland
Sand dropseed	Native	Medium	Warm	Bunchgrass	Sandy/loamy	All
Side-oats grama	Vaughn	Medium	Warm	Bunchgrass	All	Upland
Slender wheatgrass	Primar	Medium	Cool	Bunchgrass	Loamy/clayey	Bottomland
Thickspike wheatgrass	Critana	Medium	Cool	Rhizomatous	All	All
Western wheatgrass	Arriba	Medium	Cool	Rhizomatous	Loamy/clayey	All
Big bluestem	Native	Tall	Warm	Sod-former	All	Bottomland
Prairie cordgrass	Native	Tall	Warm	Sod-former	Loamy/clayey	Wetland
Prairie sandreed	Goshen	Tall	Warm	Sod-former	Sandy	All
Reed canarygrass	Native	Tall	Cool	Sod-former	Loamy/clayey	Wetland
Sand bluestem	Garden	Tall	Warm	Sod-former	Sandy	All
Switchgrass	Grenville	Tall	Warm	Sod-former	All	All
Yellow Indiangrass	Holt	Tall	Warm	Bunchgrass	Loamy	All

<sup>1</sup> Every effort should be made to obtain the specified variety; when native seed is used, it should originate from the region. When developing seed mixes, the specific location, goals, and species ecology should be considered..

Table 6-2b

Native Wildflower Species Recommended for Use at RMA <sup>1</sup>			
Species	Season	Soil Type	Moisture
Harebell	Spring	Loamy	Mesic
Lewis flax	Spring	Loamy/Clayey	Xeric/Mesic
Narrowleaf penstemon	Spring	All	Xeric
Northern sweetvetch	Spring	Loamy	Mesic
Ox-eye Daisy	Spring	All	Xeric/Mesic
Rocky Mountain iris	Spring	Loamy	Hydric
Scarlet globemallow	Spring	Loamy/Clayey	Xeric
Sego (Mariposa) lily	Spring	Loamy	Mesic
Wild onion	Spring	Loamy	Xeric
Yarrow	Spring	Loamy	Xeric
Blanketflower	Summer	Loamy/Clayey	Xeric
Silvery lupine	Summer	Sandy	Xeric
Prairie coneflower	Summer	Loamy/Clayey	Mesic
Purple prairie-clover	Summer	Loamy	Mesic
Black-eyed Susan	Summer/Fall	Loamy/Clayey	Mesic
Plains coreopsis	Summer/Fall	Loamy	Mesic
Purple coneflower	Summer/Fall	All	Mesic
Blazing star	Fall	Loamy	Xeric
Prairie sunflower	Fall	All	Xeric
Maximillian sunflower	Fall	Loamy	Xeric
Pasture Sage ('Summit')	Fall	Loamy/Clayey	Xeric/Mesic

<sup>1</sup> Includes some species not present at RMA but native (or naturalized) to the region.

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APPENDIX A

Species List

SUPPLEMENT

Cross Reference For Current Nomenclature



# APPENDIX A

## LIST OF TERRESTRIAL PLANT SPECIES OBSERVED AT ROCKY MOUNTAIN ARSENAL<sup>1</sup>

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
ACERACEAE			
Acer negundo	Box-elder	T	N
Acer saccharinum	Silver Maple	T	I
AGAVACEAE			
Yucca glauca	Spanish Bayonet	S	N
AMARANTHACEAE			
Amaranthus albus	White Pigweed	AF	I
Amaranthus arenicola	Sand Pigweed	AF	N
Amaranthus graecizans	Prostrate Pigweed	AF	I
Amaranthus retroflexus	Rough Pigweed	AF	I
Froelichia gracilis	Froelichia	AF	N
ANACARDIACEAE			
Rhus trilobata	Skunkbrush Sumac	SB	N
APOCYNACEAE			
Apocynum sibiricum	Dogbane	PF	I
ASCLEPIADACEAE			
Asclepias incarnata	Swamp Milkweed	PF	N
Asclepias pumila	Little Milkweed	PF	N
Asclepias speciosa	Showy Milkweed	PF	N
Asclepias subverticillata	Whorled Milkweed	PF	N
Asclepias viridiflora	Green Milkweed	PF	N
ASPARAGACEAE			
Asparagus officinalis	Wild Asparagus	PF	I

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
BIGNONIACEAE			
Catalpa speciosa	Showy Catalpa	T	I
BORAGINACEAE			
Cryptantha fendleri	Fendler Cryptantha	AF	N
Cryptantha minima	Small Cryptantha	AF	N
Lappula redowskii	Sand Stickseed	AF	N
Lithospermum incisum	Narrowleaf Gromwell	PF	N
CACTACEAE			
Coryphantha vivipara	Ball Cactus	S	N
Echinocereus viridiflorus	Hen-and-Chickens	S	N
Opuntia polyacantha	Prickly Pear Cactus	S	N
CAPPARIDACEAE			
Cleome serrulata	Rocky Mountain Bee Plant	AF	N
Polanisia dodecandra	Clammy-weed	AF	N
CAPRIFOLIACEAE			
Symphoricarpos occidentalis	Western Snowberry	SB	N
CARYOPHYLLACEAE			
Saponaria officianalis	Bouncing Bet	PF	I
Gypsophila paniculata	Baby's Breath	PF	I
CHENOPODIACEAE			
Atriplex hastata	Spear Orache	AF	I
Atriplex heterosperma	Orache	AF	I
Ceratoides lanata	Winterfat	SB	N
Chenopodium album	White Goosefoot	AF	I
Chenopodium leptophyllum	Narrowleaf Goosefoot	AF	N
Chenopodium rubrum	Red Goosefoot	AF	I
Cycloloma atriplicifolium	Winged Tumbleweed	AF	N
Kochia iranica	Summer-cypress	AF	I
Salsola collina	Russian-thistle	AF	I
Salsola iberica	Russian-thistle	AF	I

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
COMMELINACEAE			
Tradescantia occidentalis	Spiderwort	PF	N
COMPOSITAE (ASTERACEAE)			
Ambrosia acanthicarpa	Sand Bur	AF	N
Ambrosia psilostachya	Western Ragweed	PF	N
Ambrosia tomentosa	Spiny Bursage	PF	N
Ambrosia trifida	Giant Ragweed	AF	I
Antennaria rosea	Pussytoes	PF	N
Artemisia dracunculus	Green Sage	SS	N
Artemisia filifolia	Sand Sagebrush	SB	N
Artemisia frigida	Fringed Sage	SS	N
Artemisia ludoviciana	Pasture Sage	PF	N
Aster ericoides	Heath Aster	PF	N
Aster falcatus	White Aster	PF	N
Bidens cernua	Nodding Bur-marigold	AF	N
Bidens frondosa	Beggar's-ticks	AF	N
Carduus nutans spp. macrolepis	Bristle Thistle	BF	N
Centaurea repens	Russian Knapweed	PF	I
Chrysothamnus nauseosus	Rubber Rabbitbrush	SB	N
Cirsium arvense	Canada Thistle	PF	I
Cirsium canescens	Hoary Thistle	BF	N
Cirsium undulatum	Wavy-leaf Thistle	PF	N
Cirsium vulgare	Bull Thistle	BF	I
Conyza canadensis	Horseweed	AF	I
Dyssodia papposa	Fetid Marigold	AF	N
Erigeron divergens	Spreading Fleabane	BF	N
Erigeron pumilus	Low Daisy	PF	N
Euthamia occidentalis	Western Goldenrod	PF	N
Evax prolifera	Fluffweed	AF	N
Gnaphalium exilifolium	Cudweed	AF	N
Grindelia squarrosa	Curlycup Gumweed	AF	N
Gutierrezia sarothrae	Broom Snakeweed	SS	N
Helianthus annuus	Annual Sunflower	AF	N
Helianthus petiolaris	Prairie Sunflower	AF	N

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
Heterotheca villosa	Hairy Golden-aster	PF	N
Hymenopappus filifolius	Hymenopappus	PF	N
Iva xanthifolia	Tall Marsh-elder	AF	N
Kuhnia eupatorioides	False Boneset	PF	N
Lactuca serriola	Prickly Lettuce	AF	I
Lactuca tatarica	Blue Lettuce	PF	N
Liatris punctata	Blazing-star	PF	N
Lygodesmia juncea	Skeleton-weed	PF	N
Machaeranthera canescens	Silvery Tansy-aster	BF	N
Machaeranthera pattersonii	Patterson Tansy-aster	BF	N
Machaeranthera pinnatifida	Ironplant Goldenweed	PF	N
Nothocalais cuspidara	False Dandelion	PF	N
Onopordum acanthium	Scotch Thistle	BF	I
Picradeniopsis oppositifolia	Plains Bahia	PF	N
Podospermum laciniatum	Podospermum	BF	I
Ratibida columnifera	Prairie Coneflower	PF	N
Ratibida tagetes	Sombrero Coneflower	PF	N
Senecio plattensis	Platte Groundsel	PF	N
Senecio spartioides	Broom Butterweed	PF	N
Senecio tridenticulatus	Three-tooth Groundsel	PF	N
Solidago canadensis	Canada Goldenrod	PF	N
Solidago gigantea	Giant Goldenrod	PF	N
Solidago missouriensis	Missouri Goldenrod	PF	N
Solidago mollis	Soft Goldenrod	PF	N
Solidago speciosa var. pallida	Showy Goldenrod	PF	N
Sonchus arvensis	Perennial Sow-thistle	PF	N
Sonchus asper	Spiny Sow-thistle	AF	N
Stephanomeria pauciflora	Wire-lettuce	PF	N
Taraxacum officinale	Common Dandelion	PF	I
Thelesperma megapotamicum	Green-thread	PF	N
Tragopogon dubius	Yellow Salsify	BF	I
Verbesina encelioides	Cow-pen Daisy	AF	N
Xanthium strumarium	Cocklebur	AF	I

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
VOLVULACEAE			
Convolvulus arvensis	Field Bindweed	PF	I
Evolvulus nuttallianus	Evolvulus	PF	N
Ipomoea leptophylla	Bush Morning-glory	PF	N
CRUCIFERAE (BRASSICACEAE)			
Alyssum desertorum	Desert Alyssum	AF	I
Alyssum minus	Alyssum	AF	I
Capsella bursa-pastoris	Shepherd's-purse	AF	I
Cardaria draba	White Top	PF	I
Chorispura tenella	Common Blue Mustard	AF	I
Descurainia pinnata	Tansy-mustard	AF	N
Descurainia richardsonii	Western Tansy-mustard	AF	N
Descurainia sophia	Flixweed	AF	I
Draba reptans	White Draba	AF	N
Erysimum asperum	Western Wallflower	PF	N
Lepidium densiflorum	Prairie Peppergrass	AF	N
Lesquerella ludoviciana	Bladderpod	PF	N
Rorippa sinuata	Cress	PF	N
Sisymbrium altissimum	Tall Tumble-mustard	AF	I
Sisymbrium officinale	Tumble-mustard	AF	N
Thlaspi arvense	Field Pennycress	AF	I
CUCURBITACEAE			
Cucurbita foetidissima	Wild Gourd	PF	N
CUPRESSACEAE			
Juniperus scopulorum	Rocky Mountain Juniper	T	N
Juniperus sp.	Tammy Juniper	SB	I
CYPERACEAE			
Carex filifolia	Threadleaf Sedge	PG	N
Carex heliophila	Sun Sedge	PG	N
Carex nebrascensis	Nebraska Sedge	PG	N
Carex praeegracilis	Sedge	PG	N
Cyperus erythrorhizus	Galingale	AG	I

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
Eleocharis acicularis	Slender Spikerush	PG	N
Eleocharis macrostachya	Common Spikerush	PG	N
Scirpus acutus	Great Bulrush	PG	N
Scirpus americanus	Chairmaker's Rush	PG	N
Scirpus lacustris ssp. validus	Tule	PG	N
ELAEAGNACEAE			
Elaeagnus angustifolia	Russian-olive	T	I
EQUISETACEAE			
Hippochaete laevigata	Scouring Rush	PF	N
EUPHORBIACEAE			
Agaloma marginata	Snow-on-the-mountain	PF	N
Chamaesyce glyptosperma	Spurge	AF	N
Chamaesyce serpyllifolia	Thyme-leaved Spurge	AF	N
Croton texensis	Croton	AF	N
Euphorbia esula	Spurge	AF	I
Euphorbia spathulata	Spurge		
FUMARIACEAE			
Corydalis aurea	Golden Smoke	PF	N
GERANIACEAE			
Erodium cicutarium	Filaree, Crane's-bill	AF	I
GRAMINEAE (POACEAE)			
Agropyron cristatum	Crested Wheatgrass	PG	I
Agropyron dasystachyum	Thickspike Wheatgrass	PG	N
Agropyron desertorum	Fairway Crested Wheatgrass	PG	I
Agropyron elongatum	Tall Wheatgrass	PG	I
Agropyron repens	Quackgrass	PG	I
Agropyron smithii	Western Wheatgrass	PG	N
Agropyron trachypodium	Slender Wheatgrass	PG	N
Agrostis gigantea	Redtop	PG	I

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
<i>Andropogon hallii</i>	Sand Bluestem	PG	N
<i>Aristida fendleriana</i>	Fendler Three-awn	PG	N
<i>Aristida longiseta</i>	Red Three-awn	PG	N
<i>Beckmannia syzigachne</i>	Sloughgrass	AG	N
<i>Bouteloua curtipendula</i>	Side-oats Grama	PG	N
<i>Bouteloua gracilis</i>	Blue Grama	PG	N
<i>Bromopsis inermis</i>	Smooth Brome	PG	I
<i>Bromus japonicus</i>	Japanese Brome	AG	I
<i>Bromus tectorum</i>	Cheatgrass	AG	I
<i>Buchloe dactyloides</i>	Buffalo Grass	PG	N
<i>Calamovilfa longifolia</i>	Prairie Sandreed	PG	N
<i>Cenchrus longispinus</i>	Sand Bur	AG	N
<i>Chloris verticillata</i>	Windmill Grass	PG	I
<i>Chloris virgata</i>	Feather Fingergrass	AG	N
<i>Cynodon dactylon</i>	Bermuda Grass	PG	I
<i>Distichlis spicata</i> ssp. <i>stricta</i>	Inland Saltgrass	PG	N
<i>Echinochloa crus-galli</i>	Barnyard Grass	AG	I
<i>Elymus canadensis</i>	Canada Wildrye	PG	N
<i>Eragrostis cilianensis</i>	Stinkgrass	AG	I
<i>Eragrostis diffusa</i>	Spreading Love-grass	AG	I
<i>Festuca pratensis</i>	Meadow Fescue	PG	I
<i>Hordeum jubatum</i>	Foxtail Barley	PG	N
<i>Hordeum pusillum</i>	Little Barley	AG	N
<i>Leersia oryzoides</i>	Rice Cutgrass	PG	I
<i>Lolium multiflorum</i>	Italian Rye-grass	PG	I
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	PG	N
<i>Muhlenbergia racemosa</i>	Marsh Muhly	PG	N
<i>Muhlenbergia torreyi</i>	Ring Muhly	PG	N
<i>Munroa squarrosa</i>	False Buffalo Grass	AG	N
<i>Oryzopsis hymenoides</i>	Indian Ricegrass	PG	N
<i>Panicum capillare</i>	Witchgrass	AG	I
<i>Panicum virgatum</i>	Switchgrass	PG	N
<i>Paspalum dilatatum</i>	Dallis Grass	PG	I
<i>Phalaris arundinacea</i>	Reed Canarygrass	PG	I
<i>Phleum pratense</i>	Timothy	PG	I
<i>Poa pratensis</i>	Kentucky Bluegrass	PG	N

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
<i>Poa sandbergii</i>	Sandberg Bluegrass	PG	N
<i>Polypogon monspeliensis</i>	Rabbitfoot Grass	AG	I
<i>Schedonnardus paniculatus</i>	Tumblegrass	PG	N
<i>Secale cereale</i>	Cereal Rye	AG	I
<i>Setaria viridis</i>	Green Foxtail	AG	I
<i>Sitanion longifolium</i>	Squirreltail	PG	N
<i>Sorghastrum avenaceum</i>	Yellow Indiangrass	PG	N
<i>Spartina pectinata</i>	Prairie Cordgrass	PG	N
<i>Sphenopholis obtusata</i>	Prairie Wedge-grass	PG	N
<i>Sporobolus airoides</i>	Alkali Sacaton	PG	N
<i>Sporobolus cryptandrus</i>	Sand Dropseed	PG	N
<i>Stipa comata</i>	Needle-and-Thread	PG	N
<i>Stipa viridula</i>	Green Needlegrass	PG	N
<i>Vulpia octoflora</i>	Sixweeks Fescue	AG	N
GROSSULARIACEAE			
<i>Ribes aureum</i>	Golden Currant	SB	N
HYPERICACEAE			
<i>Hypericum perforatum</i>	Klamath Weed, St. Johnswort	PF	I
JUNCACEAE			
<i>Juncus arcticus</i> ssp. <i>ater</i>	Baltic Rush	PG	N
LABIATAE (LAMIACEAE)			
<i>Hedeoma hispidum</i>	False Pennyroyal	AF	N
<i>Lycopus americanus</i>	Water Horehound	PF	N
<i>Mentha arvensis</i>	Field Mint	PF	N
<i>Mentha spicata</i>	Spearmint	PF	I
<i>Monarda pectinata</i>	Horsemint	PF	N
<i>Nepeta cataria</i>	Catnip	PF	I
<i>Salvia reflexa</i>	Salvia	AF	N
<i>Teucrium canadense</i>	Germander	PF	N



<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
<b>LEGUMINOSAE (FABACEAE)</b>			
<i>Astragalus bisulcatus</i>	Two-grooved Milkvetch	PF	N
<i>Astragalus ceramicus</i>	Pot-sherd Milkvetch	PF	N
<i>Astragalus crassicaupus</i>	Ground Plum	PF	N
<i>Astragalus dasyglottis</i>	Purple Milkvetch	PF	N
<i>Astragalus missouriensis</i>	Missouri Milkvetch	PF	N
<i>Gleditsia triacanthos</i>	Honey Locust	T	I
<i>Glycyrrhiza lepidota</i>	Wild Licorice	PF	N
<i>Lupinus argenteus</i>	Silvery Lupine	PF	N
<i>Medicago sativa</i>	Alfalfa	PF	I
<i>Melilotus alba</i>	White Sweetclover	BF	I
<i>Melilotus officinalis</i>	Yellow Sweetclover	BF	I
<i>Oxytropis lambertii</i>	Colorado Locoweed	PF	N
<i>Petalostemon compactus</i>	Compact Prairie-clover	PF	N
<i>Psoralea lanceolata</i>	Narrowleaf Scurfpea	PF	N
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	PF	N
<i>Robinia neomexicana</i>	New Mexico Locust	T	I
<i>Robinia pseudo-acacia</i>	Black Locust	T	I
<i>Sophora nuttalliana</i>	Sophora	PF	N
<i>Vicia villosa</i>	Woolly Vetch	PF	I
<b>LEMNACEAE</b>			
<i>Lemna minor</i>	Duckweed	AF	N
<b>LILIACEAE</b>			
<i>Leucocrinum montanum</i>	Sand Lily	PF	N
<i>Smilacina racemosa</i>	False Solomon's Seal	PF	N
<i>Zigadenus venenosus</i>	Death Camas	PF	N
<b>LOASACEAE</b>			
<i>Mentzelia nuda</i>	Evening-Star	BF	N
<b>MALVACEAE</b>			
<i>Malva neglecta</i>	Buttonweed	PF	I
<i>Sphaeralcea coccinea</i>	Scarlet Globemallow	PF	N

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
URACEAE			
Morus alba	Mulberry	T	I
NYCTAGINACEAE			
Abronia fragrans	Sand Verbena	PF	N
Oxybaphus linearis	Narrowleaf Umbrella-wort	PF	N
Oxybaphus nyctagineus	Heartleaf Umbrella-wort	PF	N
OLEACEAE			
Fraxinus pennsylvanica	Green Ash	T	I
Syringa vulgaris	Common Lilac	S	I
Ligustrum vulgare	Privet	S	I
ONAGRACEAE			
Calylophus serrulatus	Serrate Evening-primrose	PF	N
Epilobium glandulosum	Northern Willow-herb	PF	N
Epilobium paniculatum	Willow-herb	AF	N
Gaura coccinea	Scarlet Butterfly-weed	PF	N
Gaura parviflora	Small-flowered Butterfly-weed	AF	N
Gayophytum ramosissimum	Ground Smoke	AF	N
Oenothera albicaulis	Prairie Evening-primrose	AF	N
Oenothera coronopifolia	Cutleaf Evening-primrose	PF	N
Oenothera nuttallii	Nuttall's Evening-primrose	PF	N
Oenothera strigosa	Tall Evening-primrose	BF	N
PAPAVERACEAE			
Argemone polyanthemus	Prickly Poppy	PF	N
PINACEAE			
Picea pungens	Blue Spruce	T	I
Pinus nigra	Austrian Pine	T	I
Pinus ponderosa	Ponderosa Pine	T	I
Pinus Sylvestris	Scotch Pine	T	I
PLANTAGINACEAE			
Plantago lanceolata	Narrowleaf Plantain	PF	I
Plantago patagonica	Pursh's Plantain	AF	N

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
POLEMONIACEAE			
Ipomopsis laxiflora	Gilia	AF	N
POLYGONACEAE			
Eriogonum annuum	Annual Wild-buckwheat	BF	N
Eriogonum effusum	Bushy Wild-buckwheat	S	N
Fallopia convolvulus	Black Bindweed	AF	I
Persicaria maculata	Lady's Thumb	PF	I
Persicaria pensylvanica	Smartweed	PF	I
Polygonum aviculare	Knotweed	AF	I
Polygonum ramocissiumum	Branched Knotweed	AF	I
Rumex crispus	Curly-leaf Dock	PF	I
Rumex salicifolius	Willow-leaf Dock	PF	N
Rumex venosus	Veiny Dock	PF	N
PORTULACACEAE			
Portulaca oleracea	Purslane	AF	I
PRIMULACEAE			
Lysimachia ciliata	Fringed Loose-strife	PF	N
RANUNCULACEAE			
Clematis ligusticifolia	Western Virgin's Bower	PF	N
Delphinium virescens	Larkspur	PF	N
Myosurus minimus	Mousetail	AF	N
ROSACEAE			
Potentilla norvegica	Cinquefoil	AF	I
Potentilla paradoxa	Cinquefoil	AF	N
Prunus americana	Wild Plum	SB	N
Prunus virginiana	Chokecherry	SB	N
Rosa arkansana	Prairie Rose	SB	N
Rosa woodsii	Woods' Rose	SB	N

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
<b>ALICACEAE</b>			
Populus alba	White Poplar	T	I
Populus sargentii	Plains Cottonwood	T	N
Populus tremuloides	Quaking Aspen	T	I
Salix amygdaloides	Peachleaf Willow	T	N
Salix exigua	Coyote Willow	SB	N
<b>SANTALACEAE</b>			
Comandra umbellata	Bastard Toadflax	PF	N
<b>SCROPHULARIACEAE</b>			
Linaria vulgaris	Butter-and-eggs	PF	N
Penstemon albidus	White Beardtongue	PF	N
Penstemon angustifolius	Narrowleaf Penstemon	PF	N
Verbascum thapsus	Great Mullein	BF	I
Veronica anagallis-aquatica	Water Speedwell	PF	N
<b>SOLANACEAE</b>			
Lycium halimifolium	Matrimony Bush	SB	I
Physalis hederifolia	Ground Cherry	PF	N
Physalis heterophylla	Ground Cherry	PF	N
Physalis virginiana	Ground Cherry	PF	N
Solanum rostratum	Buffalo Bur	AF	N
Solanum triflorum	Nightshade	AF	N
<b>TAMARICACEAE</b>			
Tamarix pentandra	Tamarisk	S	I
<b>TYPHACEAE</b>			
Typha angustifolia	Narrowleaf Cattail	PF	N
Typha latifolia	Broadleaf Cattail	PF	N
<b>ULMACEAE</b>			
Ulmus americana	American Elm	T	I
Ulmus pumila	Siberian Elm	T	I
Celtis occidentalis	Hackberry	T	N

<u>Family/Species</u>	<u>Common Name</u>	<u>Life Form</u> <sup>2</sup>	<u>Native/ Introduced</u> <sup>3</sup>
UMBELLIFERAE (APIACEAE)			
Lomatium orientale	Biscuit-root	PF	N
URTICACEAE			
Urtica dioica	Stinging Nettle	PF	N
VERBENACEAE			
Phyla cuneifolia	Fog Fruit	PF	N
Verbena bracteata	Creeping Charlie	AF	I
VIOLACEAE			
Viola nuttallii	Yellow Violet	PF	N
VITACEAE			
Parthenocissus inserta	Western Woodbine	WV	N
Vitis riparia	Wild Grape	WV	N
ZYGOPHYLLACEAE			
Tribulus terrestris	Puncture Vine	AF	I

<sup>1</sup> Nomenclature follows Weber (1976).

<sup>2</sup> AF=annual forb, AG=annual graminoid, PF=perennial forb, PG=perennial graminoid, S=succulent, SB=shrub, SS=subshrub, T=tree, WV=woody vine.

<sup>3</sup> I=intentionally or inadvertently introduced;  
N=native (occurring naturally at RMA).

SUPPLEMENT TO APPENDIX A:

CROSS-REFERENCE FOR CURRENT NOMENCLATURE<sup>1</sup>

<u>Family/Species</u>	<u>Current Nomenclature</u>
ACERACEAE	
Acer negundo	Negundo aceroides
AMARANTHACEAE	
Amaranthus graecizans	Amaranthus blitoides
ANACARDIACEAE	
Rhus trilobata	Rhus aromatica
APOCYNACEAE	
Apocynum sibiricum	Apocynum cannabinum
CHENOPODIACEAE	
Ceratoides lanata	Krascheninnikovia lanata
Kochia iranica	Kochia sieversiana
Salsola iberica	Salsola australis
COMPOSITAE (ASTERACEAE)	
Artemisia dracunculus	Oligosporus dracunculus
Artemisia filifolia	Oligosporus filifolius
Aster ericoides	Virgulus ericoides
Aster falcatus	Virgulus falcatus
Centaurea repens	Acroptilon repens
Iva xanthifolia	Cyclachaena xanthifolia
Kuhnia eupatorioides	Brickellia eupatorioides
Senecio plattensis	Pachera plattensis
Senecio tridenticulatus	Pachera tridenticulata
Solidago gigantea	Solidago serotinoidea
Verbesina encelioides	Ximenesia encelioides
CUPRESSACEAE	
Juniperus scopulorum	Sabina scopulorum

CROSS-REFERENCE FOR CURRENT NOMENCLATURE<sup>1</sup>

<u>Family Species</u>	<u>Current Nomenclature</u>
<b>CYPERACEAE</b>	
Carex heliophila	Carex pensylvanica ssp. heliophila
Eleocharis macrostachya	Eleocharis palustris
Scirpus acutus	Schoenoplectus lacustris
<b>CYPERACEAE (Continued)</b>	
Scirpus americanus	Schoenoplectus pungens
Scirpus lacustris ssp. validus	Schoenoplectus lacustris
<b>EUPHORBIACEAE</b>	
Euphorbia esula	Tithymalus esula
Euphorbia spathulata	Tithymalus spathulata
<b>GRAMINEAE (POACEAE)</b>	
Agropyron dasystachyum	Elytrigia dasystachya
Agropyron desertorum	Agropyron cristatum
Agropyron elongatum	Lophopyrum elongatum
Agropyron repens	Elytrigia repens
Agropyron smithii	Pascopyrum smithii
Agropyron trachycaulum	Elymus trachycaulus
Aristida fendleriana	Aristida purpurea
Aristida longiseta	Aristida purpurea var. longiseta
Bromus tectorum	Anisantha tectorum
Hordeum jubatum	Critesion jubatum
Hordeum pusillum	Critesion pusillum
Lolium multiflorum	Lolium perenne
Munroa squarrosa	Monroa squarrosa
Sitanion longifolium	Elymus elymoides
<b>LEGUMINOSAE (FABACEAE)</b>	
Astragalus dasyglottis	Astragalus agrestis
Petalostemon compactus	Dalea cylindriceps
Psoralea lanceolata	Psoralidium lanceolatum
Psoralea tenuiflora	Psoralidium tenuiflorum
Sophora nuttalliana	Vexibia nuttalliana
<b>LILIACEAE</b>	
Smilacina racemosa	Maianthemum amplexicaule
Zigadenus venenosus	Toxicoscordion venenosum

CROSS-REFERENCE FOR CURRENT NOMENCLATURE<sup>1</sup>

<u>Family/Species</u>	<u>Current Nomenclature</u>
<b>LOASACEAE</b>	
Mentzelia nuda	Nuttallia nuda
<b>ONAGRACEAE</b>	
Epilobium glandulosum	Epilobium ciliatum ssp. glandulosum
Epilobium paniculatum	Epilobium brachycarpum
Oenothera strigosa	Oenothera villosa
<b>POLYGONACEAE</b>	
Rumex salicifolius	Rumex triangulivalvis
<b>PRIMULACEAE</b>	
Lysimachia ciliata	Steironema ciliatum
<b>RANUNCULACEAE</b>	
Delphinium virescens	Delphinium carolinianum ssp. penardii
<b>ROSACEAE</b>	
Potentilla paradoxa	Potentilla supina ssp. paradoxa
Prunus virginiana melanocarpa	Padus virginiana ssp.
<b>SALICACEAE</b>	
Populus sargentii	Populus deltoides
<b>SOLANACEAE</b>	
Lycium halimifolium	Lycium barbarum
Physalis hederifolia	Physalis hederifolia
<b>TAMARICACEAE</b>	
Tamarix pentandra	Tamarix parviflora



CROSS-REFERENCE FOR CURRENT NOMENCLATURE<sup>1</sup>

<u>Family/Species</u>	<u>Current Nomenclature</u>
URTICACEAE	
Urtica dioica	Urtica gracilis

<sup>1</sup> Current nomenclature follows Wittmann, Weber, and Johnston (1988).

APPENDIX B

(Tables 1 through 79)

Data Summaries and Species Lists for  
Onsite and Offsite Vegetation Types

Table 1.  
COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
WEEDY FORB TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON  
DATA FROM 49 SAMPLING LOCATIONS. 1986 DATA. +/- VALUES  
EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron smithii	0.58	1.97	0 - 12	9.43	2.36	4.33	10
Aristida longiseta	1.06	3.56	0 - 32	9.43	2.36	5.91	8
Sub-total	1.64	5.52					
WARM SEASON PERENNIAL GRASSES							
Sporobolus cryptandrus	0.11	0.38	0 - 6	1.89	0.47	0.85	27
Sub-total	0.11	0.38					
INTRODUCED PERENNIAL GRASSES							
Agropyron desertorum	0.13	0.44	0 - 7	1.89	0.47	0.92	26
Sub-total	0.13	0.44					
ANNUAL GRASSES							
Bromus tectorum	4.57	15.37	0 - 78	35.85	8.96	24.33	3
Panicum capillare	0.11	0.38	0 - 6	1.89	0.47	0.85	27
Sub-total	4.68	15.75					
PERENNIAL FORBS							
Ambrosia psilostachya	0.38	1.27	0 - 11	7.55	1.89	3.16	14
Aster falcatus	0.09	0.32	0 - 2	7.55	1.89	2.20	17
Convolvulus arvensis	4.32	14.54	0 - 33	49.06	12.26	26.80	2
Gaura coccinea	0.02	0.06	0 - 1	1.89	0.47	0.54	31
Heterotheca villosa	0.08	0.25	0 - 2	5.66	1.42	1.67	21
Kuhnia eupatorioides	0.15	0.51	0 - 3	11.32	2.83	3.34	13
Lygodesmia juncea	0.02	0.06	0 - 1	1.89	0.47	0.54	31
Oenothera coronopifolia	0.51	1.71	0 - 11	9.43	2.36	4.07	11
Physalis virginiana	0.02	0.06	0 - 1	1.89	0.47	0.54	31

Table 1. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Psoralea tenuiflora</i>	0.08	0.25	0 - 3	3.77	0.94	1.20	22
<i>Senecio tridenticulatus</i>	0.04	0.13	0 - 1	3.77	0.94	1.07	25
<i>Sphaeralcea coccinea</i>	1.30	4.38	0 - 13	32.08	8.02	12.40	4
<i>Verbascum thapsus</i>	0.11	0.38	0 - 6	1.89	0.47	0.85	27
Sub-total	7.11	23.94					
ANNUAL AND BIENNIAL FORBS							
<i>Amaranthus albus</i>	0.23	0.76	0 - 10	3.77	0.94	1.71	20
<i>Amaranthus graecizans</i>	0.43	1.46	0 - 18	3.77	0.94	2.40	15
<i>Ambrosia acanthicarpa</i>	0.02	0.06	0 - 1	1.89	0.47	0.54	31
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	0.11	0.38	0 - 4	5.66	1.42	1.80	19
<i>Conyza canadensis</i>	0.02	0.06	0 - 1	1.89	0.47	0.54	31
<i>Cryptantha fendleri</i>	0.04	0.13	0 - 2	1.89	0.47	0.60	30
<i>Cryptantha minima</i>	0.06	0.19	0 - 2	3.77	0.94	1.13	23
<i>Descurainia richardsonii</i>	1.21	4.06	0 - 19	15.09	3.77	7.84	7
<i>Dyssodia papposa</i>	0.06	0.19	0 - 2	3.77	0.94	1.13	23
<i>Gaura parviflora</i>	0.11	0.38	0 - 6	1.89	0.47	0.85	27
<i>Helianthus annuus</i>	0.04	0.13	0 - 2	1.89	0.47	0.60	30
<i>Helianthus petiolaris</i>	0.09	0.32	0 - 5	1.89	0.47	0.79	28
<i>Iva xanthifolia</i>	0.19	0.63	0 - 10	1.89	0.47	1.11	24
<i>Kochia iranica</i>	9.60	32.32	0 - 42	64.15	16.04	48.36	1
<i>Lactuca serriola</i>	1.40	4.70	0 - 19	24.53	6.13	10.83	5
<i>Lappula redowskii</i>	0.17	0.57	0 - 2	11.32	2.83	3.40	12
<i>Plantago patagonica</i>	0.15	0.51	0 - 4	5.66	1.42	1.92	18
<i>Salsola iberica</i>	0.04	0.13	0 - 1	3.77	0.94	1.07	25
<i>Sisymbrium altissimum</i>	1.26	4.25	0 - 24	16.98	4.25	8.50	6
<i>Solanum triflorum</i>	0.08	0.25	0 - 3	3.77	0.94	1.20	22
<i>Verbena bracteata</i>	0.51	1.71	0 - 12	11.32	2.83	4.54	9
<i>Verbesina encelioides</i>	0.15	0.51	0 - 5	7.55	1.89	2.39	16
Sub total	15.96	53.71					

Table 1. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I. V.	Rank
SEMI-SHRUBS OR HALF-SHRUBS							
<i>Artemisia frigida</i>	0.02	0.06	0 - 1	1.89	0.47	0.54	31
Sub-total	0.02	0.06					
SHRUBS							
<i>Prigonum effusum</i>	0.06	0.19	0 - 3	1.89	0.47	0.66	29
Sub-total	0.06	0.19					
SUM OF SPECIES COVER	29.72						
TOTAL VEGETATION							
LITTER/ROCK	29.57 +/-	17.78					
BARE SOIL	48.66 +/-	15.06					
TOTAL COVER	21.77 +/-	15.82					
	78.23 +/-	15.82					
Number of Species/sample	4.00						

Table 2. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE WEEDY FORB TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

HEIGHTS OF MAJOR SPECIES			
SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
<i>Aristida longiseta</i>	18	1	2
WARM SEASON PERENNIAL GRASSES			
<i>Sporobolus cryptandrus</i>	15		1
INTRODUCED PERENNIAL GRASSES			
<i>Agropyron desertorum</i>	6		1
ANNUAL GRASSES			
<i>Bromus tectorum</i>	32	15	10
PERENNIAL FORBS			
<i>Ambrosia psilostachya</i>	21	5	3
<i>Convolvulus arvensis</i>	7	3	9
<i>Heterotheca villosa</i>	15	0	2
<i>Oenothera coronopifolia</i>	9		1
<i>Sphaeralcea coccinea</i>	8	3	6
ANNUAL AND BIENNIAL FORBS			
<i>Amaranthus graecizans</i>	6		1
<i>Cleome serrulata</i>	45		1
<i>Conyza canadensis</i>	52		1
<i>Descurainia richardsonii</i>	48	24	3
<i>Gaura parviflora</i>	93		1
<i>Helianthus annuus</i>	62		1
<i>Kochia iranica</i>	19	23	32
<i>Lactuca serriola</i>	59	23	8
<i>Salsola iberica</i>	14		1
<i>Sisymbrium altissimum</i>	69	21	8
<i>Verbena bracteata</i>	8		1
SHRUBS			
<i>Eriogonum effusum</i>	12		1

Table 2. (CONT'D)

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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 61)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
Eriogonum effusum	272	1407
Opuntia polyacantha	5	38
Yucca glauca	57	435
TOTAL	334	1463

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Table 3.

PRODUCTION SUMMARY FOR THE WEEDY FORB TYPE AT  
THE ROCKY MOUNTAIN ARSENAL. BASED ON 1986 DATA  
FROM 49 SAMPLING LOCATIONS. +/- VALUES EQUAL THE  
STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	3.71	0.00 - 61.10	2.99
Aristida longiseta	0.26	0.00 - 9.42	0.21
Sitanion longifolium	0.02	0.00 - 0.90	0.01
Stipa comata	0.04	0.00 - 1.97	0.03
Sub-total	4.03		3.25
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	0.01	0.00 - 0.62	0.01
Sporobolus cryptandrus	0.05	0.00 - 2.05	0.04
Sub-total	0.06		0.05
ANNUAL GRASSES			
Bromus tectorum	5.93	0.00 -239.91	4.78
Vulpia octoflora	0.01	0.00 - 0.34	0.01
Sub-total	5.93		4.79
PERENNIAL FORBS			
Ambrosia psilostachya	4.31	0.00 -138.19	3.47
Astragalus missouriensis	0.02	0.00 - 1.12	0.02
Centaurea repens	0.07	0.00 - 3.65	0.06
Convolvulus arvensis	12.61	0.00 -267.60	10.17
Gaura coccinea	0.08	0.00 - 3.91	0.06
Heterotheca villosa	0.02	0.00 - 1.29	0.02
Kuhnia eupatorioides	0.18	0.00 - 9.47	0.15
Lygodesmia juncea	0.38	0.00 - 10.18	0.31
Oenothera coronopifolia	3.58	0.00 - 62.84	2.89
Oxybaphus linearis	0.08	0.00 - 3.75	0.07
Physalis hederifolia	0.02	0.00 - 1.00	0.02
Physalis virginiana	0.04	0.00 - 1.85	0.03
Psoralea tenuiflora	0.02	0.00 - 0.84	0.02
Senecio spartioides	0.16	0.00 - 8.44	0.13
Sphaeralcea coccinea	6.92	0.00 - 74.95	5.59
Sub-total	28.49		22.98
ANNUAL AND BIENNIAL FORBS			
Amaranthus albus	0.19	0.00 - 9.89	0.15



Table 3. (cont'd).

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
<i>Amaranthus graecizans</i>	5.12	0.00 - 241.88	4.13
<i>Amaranthus retroflexus</i>	0.00	0.00 - 0.05	0.00
<i>Chamaesyce serpyllifolia</i>	0.05	0.00 - 1.82	0.04
<i>Conyza canadensis</i>	0.13	0.00 - 2.73	0.11
<i>Croton texensis</i>	0.00	0.00 - 0.22	0.00
<i>Cryptantha minima</i>	0.34	0.00 - 11.36	0.28
<i>Descurainia richardsonii</i>	3.85	0.00 - 72.34	3.10
<i>Dyssodia papposa</i>	0.02	0.00 - 1.03	0.02
<i>Erigeron divergens</i>	0.10	0.00 - 5.33	0.08
<i>Eriogonum annuum</i>	0.00	0.00 - 0.20	0.00
<i>Helianthus annuus</i>	1.02	0.00 - 52.88	0.82
<i>Iva xanthifolia</i>	0.04	0.00 - 2.01	0.03
<i>Kochia iranica</i>	58.08	0.00 - 371.13	46.84
<i>Lactuca serriola</i>	8.66	0.00 - 120.93	6.98
<i>Lappula redowskii</i>	0.00	0.00 - 35.94	0.70
<i>Lepidium densiflorum</i>	0.01	0.00 - 0.43	0.01
<i>Oenothera albicaulis</i>	0.05	0.00 - 2.44	0.04
<i>Plantago patagonica</i>	0.60	0.00 - 23.58	0.51
<i>Polygonum aviculare</i>	0.01	0.00 - 0.29	0.00
<i>Salsola iberica</i>	0.00	0.00 - 14.70	0.53
<i>Sisymbrium altissimum</i>	1.50	0.00 - 41.05	1.25
<i>Solanum triflorum</i>	0.85	0.00 - 21.69	0.68
<i>Verbena bracteata</i>	2.34	0.00 - 45.36	1.89
<i>Verbesina encelioides</i>	0.36	0.00 - 18.92	0.29
Sub-total	84.92		68.50
SEMI-SHRUBS OR HALF-SHRUBS			
<i>Gutierrezia sarothrae</i>	0.54	0.00 - 28.12	0.44
TOTAL PRODUCTION	121.03	+/- 94.05	

Table 4.

LIST OF SPECIES OBSERVED GROWING IN THE WEEDY FORB TYPE AT  
THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS MADE  
DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Hordeum jubatum</i>	Foxtail Barley	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Cenchrus longispinus</i>	Sand Bur	Gramineae
<i>Chloris virgata</i>	Windmill Grass	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Munroa squarrosa</i>	False Buffalo Grass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Agaloma marginata</i>	Snow-on-the-mountain	Euphorbiaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus missouriensis</i>	Missouri Milkvetch	Leguminosae
<i>Centaurea repens</i>	Russian Knapweed	Compositae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erysimum asperum</i>	Western Wallflower	Cruciferae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Hypericum perforatum</i>	Klamath Weed	Hypericaceae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae

Table 4. (cont'd.)

Scientific Name	Common Name	Family Name
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Oxybaphus nyctagineus</i>	Heart-leaved Umbrella Wort	Nyctaginaceae
<i>Petalostemon compactus</i>	Compact Prairie Clover	Leguminosae
<i>Physalis hederacefolia</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Picradeniopsis oppositifolia</i>	Plains Bahia	Compositae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Rumex crispus</i>	Curly Dock	Polygonaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Solidago missouriensis</i>	Missouri Goldenrod	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Tradescantia occidentalis</i>	Spiderwort	Commelinaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
ANNUAL AND BIENNIAL FORBS		
<i>Alyssum minus</i>	Alyssum	Cruciferae
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Amaranthus arenicola</i>	Sand Pigweed	Amaranthaceae
<i>Amaranthus graecizans</i>	Prostrate Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Ambrosia acanthicarpa</i>	Sand-bur	Compositae
<i>Artemisia biennis</i>	Biennial Wormwood	Compositae
<i>Carduus nutans ssp. macrolepis</i>	Bristle Thistle	Compositae
<i>Centaurea diffusa</i>	Knapweed	Compositae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Chorispora tenella</i>	Common Blue Mustard	Cruciferae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Cleome serrulata</i>	Rocky Mt. Bee Plant	Capparidaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Cryptantha fendleri</i>	Fendler Cryptantha	Boraginaceae
<i>Cryptantha minima</i>	Small Cryptantha	Boraginaceae

Table 4.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Descurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Descurainia sophia</i>	Flixweed	Cruciferae
<i>Dyssodia papposa</i>	Fetid Marigold	Compositae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Hedeoma hispidum</i>	False Pennyroyal	Labiatae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Helianthus petiolaris</i>	Prairie Sunflower	Compositae
<i>Iva xanthifolia</i>	Marsh Elder	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lappula redowskii</i>	Beggars-tick	Boraginaceae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Oenothera albicaulis</i>	Prairie Evening Primrose	Onagraceae
<i>Oenothera</i> sp.	Evening Primrose	Onagraceae
<i>Oenothera strigosa</i>	Evening Primrose	Onagraceae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissimum</i>	Branched Knotweed	Polygonaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Thlaspi arvense</i>	Field Pennycress	Cruciferae
<i>Tribulus terrestris</i>	Puncture Vine	Zygophyllaceae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia dracunculus</i>	Green Sage	Compositae
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
<i>Gutierrezia sarothrae</i>	Broom Snakeweed	Compositae
SHRUBS		
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae

Table 4 .(cont'd.)

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Scientific Name	Common Name	Family Name
Yucca glauca	Spanish Bayonet	Agavaceae

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Table 5.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CHEATGRASS/WEEDY FORB TYPE AT THE ROCKY MOUNTAIN ARSENAL.  
BASED ON DATA FROM 72 SAMPLING LOCATIONS. 1986 DATA. +/-  
VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
Agropyron smithii	0.23	0.50	0 - 5	7.59	1.60	2.09	17
Agropyron trachycaulum	0.15	0.33	0 - 10	3.80	0.80	1.13	25
Aristida longiseta	0.39	0.86	0 - 10	13.92	2.93	3.78	9
Distichlis stricta	0.06	0.14	0 - 5	1.27	0.27	0.40	35
Schedonnardus paniculatus	0.03	0.06	0 - 1	2.53	0.53	0.59	33
Sitanion longifolium	0.06	0.14	0 - 4	2.53	0.53	0.67	30
Stipa comata	0.35	0.77	0 - 14	6.33	1.33	2.10	16
Sub-total	1.28	2.79					
<b>WARM SEASON PERENNIAL GRASSES</b>							
Bouteloua gracilis	0.03	0.06	0 - 1	2.53	0.53	0.59	33
Sporobolus cryptandrus	1.29	2.82	0 - 12	32.91	6.91	9.74	4
Sub-total	1.32	2.88					
<b>INTRODUCED PERENNIAL GRASSES</b>							
Agropyron desertorum	0.29	0.64	0 - 10	10.13	2.13	2.76	13
Poa pratensis	0.05	0.11	0 - 2	2.53	0.53	0.64	31
Sub-total	0.34	0.75					
<b>ANNUAL GRASSES</b>							
Bromus japonicus	0.48	1.05	0 - 27	7.59	1.60	2.65	14
Bromus tectorum	29.22	63.83	0 - 78	98.73	20.74	84.57	1
Sub-total	29.70	64.88					
<b>PERENNIAL FORBS</b>							
Ambrosia psilostachya	0.51	1.11	0 - 16	12.66	2.66	3.77	10
Asclepias speciosa	0.11	0.25	0 - 6	3.80	0.80	1.05	27

Table 5.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I. V.	Rank
<i>Aster falcatus</i>	0.78	1.71	0 - 20	13.92	2.93	4.64	6
<i>Cirsium arvense</i>	0.78	1.71	0 - 20	10.13	2.13	3.84	8
<i>Convolvulus arvensis</i>	4.67	10.20	0 - 38	44.30	9.31	19.51	2
<i>Evolvulus nuttallianus</i>	0.05	0.11	0 - 2	2.53	0.53	0.64	31
<i>Gaura coccinea</i>	0.03	0.06	0 - 1	2.53	0.53	0.59	33
<i>Heterotheca villosa</i>	0.14	0.30	0 - 5	3.80	0.80	1.10	26
<i>Lygodesmia juncea</i>	0.05	0.11	0 - 3	2.53	0.53	0.64	31
<i>Mentzelia nuda</i>	0.13	0.28	0 - 6	5.06	1.06	1.34	22
<i>Oxybaphus linearis</i>	0.06	0.14	0 - 5	1.27	0.27	0.40	35
<i>Oxybaphus nyctagineus</i>	0.06	0.14	0 - 3	3.80	0.80	0.94	28
<i>Phyla cunelifolia</i>	0.04	0.08	0 - 1	3.80	0.80	0.88	29
<i>Physalis hederifolia</i>	0.14	0.30	0 - 4	6.33	1.33	1.63	19
<i>Physalis heterophylla</i>	0.04	0.08	0 - 1	3.80	0.80	0.88	29
<i>Physalis virginiana</i>	0.09	0.19	0 - 2	6.33	1.33	1.52	20
<i>Psoralea tenuiflora</i>	0.15	0.33	0 - 5	8.86	1.86	2.19	15
<i>Senecio tridenticulatus</i>	0.01	0.03	0 - 1	1.27	0.27	0.29	38
<i>Sphaeralcea coccinea</i>	0.35	0.77	0 - 8	16.46	3.46	4.23	7
<i>Verbascum thapsus</i>	0.15	0.33	0 - 6	6.33	1.33	1.66	18
Sub-total	8.35	18.25					
ANNUAL AND BIENNIAL FORBS							
<i>Amaranthus albus</i>	0.04	0.08	0 - 2	2.53	0.53	0.61	32
<i>Amaranthus graecizans</i>	0.01	0.03	0 - 0	1.27	0.27	0.29	38
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	2.35	5.14	0 - 25	29.11	6.12	11.26	3
<i>Chamaesyce glyptosperma</i>	0.01	0.03	0 - 1	1.27	0.27	0.29	38
<i>Chenopodium album</i>	0.01	0.03	0 - 1	1.27	0.27	0.29	38
<i>Conyza canadensis</i>	0.01	0.03	0 - 1	1.27	0.27	0.29	38
<i>Descurainia richardsonii</i>	0.05	0.11	0 - 2	1.27	0.27	0.38	36
<i>Gaura parviflora</i>	0.27	0.58	0 - 4	13.92	2.93	3.51	11

Table 5.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
BARE SOIL	4.87 +/-	9.32					
TOTAL COVER	95.13 +/-	9.32					
Number of Species/sample	4.76						



Table 5. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Helianthus annuus</i>	0.04	0.08	0 - 2	2.53	0.53	0.61	32
<i>Kochia iranica</i>	0.18	0.39	0 - 11	5.06	1.06	1.45	21
<i>Lactuca serriola</i>	0.86	1.88	0 - 0	21.52	4.52	6.40	5
<i>Lappula redowskii</i>	0.13	0.28	0 - 7	5.06	1.06	1.34	22
<i>Oenothera strigosa</i>	0.10	0.22	0 - 0	1.27	0.27	0.49	34
<i>Plantago patagonica</i>	0.03	0.06	0 - 2	1.27	0.27	0.32	37
<i>Polygonum ramocissimum</i>	0.01	0.03	0 - 1	1.27	0.27	0.29	38
<i>Salsola iberica</i>	0.06	0.14	0 - 2	5.06	1.06	1.20	24
<i>Sisymbrium altissimum</i>	0.27	0.58	0 - 6	12.66	2.66	3.24	12
<i>Solanum triflorum</i>	0.01	0.03	0 - 0	1.27	0.27	0.29	38
<i>Verbena bracteata</i>	0.10	0.22	0 - 3	5.06	1.06	1.29	23
<i>Verbesina encelloides</i>	0.06	0.14	0 - 4	2.53	0.53	0.67	30
Sub-total	4.61	10.07					
SHRUBS							
<i>Artemisia filifolia</i>	0.05	0.11	0 - 3	2.53	0.53	0.64	31
<i>Chrysothamnus nauseosus</i>	0.05	0.11	0 - 0	1.27	0.27	0.38	36
<i>Eriogonum effusum</i>	0.01	0.03	0 - 0	1.27	0.27	0.29	38
Sub-total	0.11	0.25					
CACTI AND SUCCULENTS							
<i>Yucca glauca</i>	0.06	0.14	0 - 3	2.53	0.53	0.67	30
Sub-total	0.06	0.14					
SUM OF SPECIES COVER	45.77						
TOTAL VEGETATION							
LITTER/ROCK	45.81 +/-	14.83					
	49.32 +/-	13.91					

Table 6. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE CHEATGRASS/WEEDY FORB TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
<i>Agropyron smithii</i>	21		1
<i>Aristida longiseta</i>	14		1
<i>Stipa comata</i>	37	10	3
WARM SEASON PERENNIAL GRASSES			
<i>Sporobolus cryptandrus</i>	22	6	11
INTRODUCED PERENNIAL GRASSES			
<i>Agropyron desertorum</i>	36	18	2
ANNUAL GRASSES			
<i>Bromus japonicus</i>	41		1
<i>Bromus tectorum</i>	31	12	72
PERENNIAL FORBS			
<i>Ambrosia psilostachya</i>	17	3	2
<i>Cirsium arvense</i>	30	7	3
<i>Convolvulus arvensis</i>	13	6	15
<i>Sphaeralcea coccinea</i>	15	11	2
ANNUAL AND BIENNIAL FORBS			
<i>Carduus nutans</i>	84	17	16
<i>Gaura parviflora</i>	88	38	3
<i>Helianthus annuus</i>	34		1
<i>Kochia iranica</i>	9	1	2
<i>Lactuca serriola</i>	54	13	3
<i>Salsola iberica</i>	12	4	2
<i>Sisymbrium altissimum</i>	74		1
SHRUBS			
<i>Eriogonum effusum</i>	19		1

Table 6.

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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 79)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
Artemisia filifolia	6	40
Chrysothamnus nauseosus	3	23
Eriogonum effusum	179	870
Opuntia compressa	3	23
Opuntia polyacantha	23	91
Yucca glauca	35	212
TOTAL	249	990

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Table 7.

PRODUCTION SUMMARY FOR THE CHEATGRASS/WEEDY FORB  
TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON 1986  
DATA FROM 72 SAMPLING LOCATIONS. +/- VALUES EQUAL  
THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	0.97	0.00 - 52.34	0.69
Agropyron trachycaulum	1.11	0.00 - 87.55	0.79
Aristida longiseta	0.63	0.00 - 28.67	0.45
Sitanion longifolium	0.07	0.00 - 2.31	0.05
Stipa comata	1.17	0.00 - 84.87	0.83
Sub-total	3.94		2.81
WARM SEASON PERENNIAL GRASSES			
Louteloua gracilis	0.20	0.00 - 14.21	0.14
Sporobolus cryptandrus	4.65	0.00 - 82.85	3.32
Sub-total	4.85		3.46
PRODUCED PERENNIAL GRASSES			
Agropyron desertorum	1.24	0.00 - 69.73	0.89
ANNUAL GRASSES			
Bromus japonicus	0.87	0.00 - 68.54	0.62
Bromus tectorum	70.24	0.00 - 561.82	50.13
Vulpia octoflora	0.00	0.00 - 0.15	0.00
Sub-total	71.11		50.75
PERENNIAL FORBS			
Ambrosia psilostachya	7.60	0.00 - 190.67	5.43
Aster falcatus	0.26	0.00 - 18.09	0.18
Astragalus dasyglottis	0.05	0.00 - 3.82	0.03
Cardaria draba	1.42	0.00 - 111.90	1.01
Cirsium arvense	6.80	0.00 - 157.97	4.86
Convolvulus arvensis	6.66	0.00 - 106.52	4.75
Evolvulus nuttallianus	0.03	0.00 - 2.17	0.02
Gaura coccinea	0.03	0.00 - 2.40	0.02
Grindelia squarrosa	0.03	0.00 - 2.11	0.02
Lithospermum incisum	0.00	0.00 - 0.23	0.00
Lygodesmia juncea	0.88	0.00 - 34.02	0.63
Mentzelia nuda	0.01	0.00 - 0.84	0.01
Oxybaphus linearis	0.02	0.00 - 1.16	0.02
Phyla cuneifolia	0.04	0.00 - 3.18	0.03

le 7 .(cont'd).

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
<i>Physalis hederifolia</i>	0.12	0.00 - 5.22	0.08
<i>Physalis heterophylla</i>	0.49	0.00 - 23.96	0.35
<i>Physalis virginiana</i>	0.24	0.00 - 14.71	0.17
<i>Psoralea tenuiflora</i>	0.16	0.00 - 7.52	0.12
<i>Sphaeralcea coccinea</i>	1.86	0.00 - 27.58	1.32
<i>Verbascum thapsus</i>	0.09	0.00 - 5.19	0.06
Sub-total	26.78		19.11
ANNUAL AND BIENNIAL FORBS			
<i>Amaranthus albus</i>	4.59	0.00 - 356.29	3.28
<i>Amaranthus graecizans</i>	0.01	0.00 - 0.88	0.01
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	12.58	0.00 - 209.45	8.98
<i>Chamaesyce glyptosperma</i>	0.02	0.00 - 1.69	0.02
<i>Chamaesyce serpyllifolia</i>	0.02	0.00 - 0.77	0.01
<i>Chenopodium album</i>	0.09	0.00 - 5.20	0.06
<i>Chenopodium leptophyllum</i>	0.00	0.00 - 0.15	0.00
<i>Cleome serrulata</i>	0.61	0.00 - 48.25	0.44
<i>Conyza canadensis</i>	0.02	0.00 - 0.62	0.01
<i>Croton texensis</i>	0.04	0.00 - 2.97	0.03
<i>Descurainia richardsonii</i>	0.68	0.00 - 44.64	0.49
<i>Erigeron divergens</i>	0.01	0.00 - 0.45	0.01
<i>Gaura parviflora</i>	4.14	0.00 - 135.39	2.95
<i>Helianthus petiolaris</i>	1.17	0.00 - 59.37	0.83
<i>Kochia iranica</i>	0.29	0.00 - 9.33	0.21
<i>Lactuca serriola</i>	5.24	0.00 - 130.76	3.74
<i>Lappula redowskii</i>	0.00	0.00 - 0.12	0.00
<i>Lepidium densiflorum</i>	0.00	0.00 - 0.11	0.00
<i>Melilotus officinalis</i>	0.02	0.00 - 1.75	0.02
<i>Polygonum aviculare</i>	0.08	0.00 - 6.49	0.06
<i>Portulaca oleracea</i>	0.04	0.00 - 2.68	0.03
<i>Salsola iberica</i>	1.45	0.00 - 89.83	1.04
<i>Sisymbrium altissimum</i>	1.07	0.00 - 36.70	0.76
<i>Verbesina encelioides</i>	0.01	0.00 - 0.41	0.00
Sub-total	32.18		22.97
TOTAL PRODUCTION	140.28	+/- 98.24	

Table 8.

LIST OF SPECIES OBSERVED IN THE CHEATGRASS/WEEDY FORB TYPE  
AT THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS MADE  
DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Distichlis stricta</i>	Inland Saltgrass	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Hordeum jubatum</i>	Foxtail Barley	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<i>Stipa viridula</i>	Green Needle Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Agropyron repens</i>	Quackgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Setaria viridis</i>	Green Foxtail	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Abronia fragrans</i>	Sand Verbena	Nyctaginaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Asclepias viridiflora</i>	Green Milkweed	Asclepiadaceae
<i>Asparagus officinalis</i>	Asparagus	Asparagaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus dasyglottis</i>	Purple Milk Vetch	Leguminosae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Centaurea repens</i>	Russian Knapweed	Compositae
<i>Cirsium arvense</i>	Canada Thistle	Compositae

Table 8.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Cucurbita foetidissima</i>	Wild Gourd	Cucurbitaceae
<i>Euphorbia spathulata</i>	Spurge	Euphorbiaceae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Ipomoea leptophylla</i>	Bush Morning Glory	Convolvulaceae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Liatris punctata</i>	Gay Feather	Compositae
<i>Lithospermum incisum</i>	Narrowleaf Gromwell	Boraginaceae
<i>Lupinus argenteus</i>	Silvery Lupine	Leguminosae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Oxybaphus nyctagineus</i>	Heart-leaved Umbrella Wort	Nyctaginaceae
<i>Phyla cuneifolia</i>	Fog Fruit	Verbenaceae
<i>Physalis hederæfolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Rumex crispus</i>	Curly Dock	Polygonaceae
<i>Rumex venosus</i>	Veiny Dock	Polygonaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Taraxacum officinale</i>	Common Dandelion	Compositae
<i>Thelesperma megapotamicum</i>	Thelesperma	Compositae
<i>Tradescantia occidentalis</i>	Spiderwort	Commelinaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
ANNUAL AND BIENNIAL FORBS		
<i>Alyssum desertorum</i>	Desert Alyssum	Cruciferae
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Amaranthus graecizans</i>	Prostrate Pigweed	Amaranthaceae
<i>Ambrosia acanthicarpa</i>	Sand-bur	Compositae
<i>Carduus nutans ssp. macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae

Table 8.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Chorispora tenella</i>	Common Blue Mustard	Cruciferae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Cirsium vulgare</i>	Bull Thistle	Compositae
<i>Cleome serrulata</i>	Rocky Mt. Bee Plant	Capparidaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Cryptantha minima</i>	Small Cryptantha	Boraginaceae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Descurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Descurainia sophia</i>	Flixweed	Cruciferae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Helianthus petiolaris</i>	Prairie Sunflower	Compositae
<i>Iva xanthifolia</i>	Marsh Elder	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lappula redowskii</i>	Beggars-tick	Boraginaceae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Machaeranthera pattersonii</i>	Patterson Aster	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Oenothera strigosa</i>	Evening Primrose	Onagraceae
<i>Onopordum acanthium</i>	Scotch Thistle	Composite
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Podospermum laciniatum</i>	Podospermum	Compositae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Salvia reflexa</i>	Salvia	Labiatae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Thlaspi arvense</i>	Field Pennycress	Cruciferae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae



Table 8. (cont'd.)

Scientific Name	Common Name	Family Name
<i>Xanthium strumarium</i>	Cocklebur	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia dracunculus</i>	Green Sage	Compositae
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
SHRUBS		
<i>Artemisia filifolia</i>	Sand Sage	Compositae
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
<i>Lycium halimifolium</i>	Matrimony Bush	Solanaceae
<i>Salix exigua</i>	Coyote Willow	Salicaceae
CACTI AND SUCCULENTS		
<i>Coryphantha vivipara</i>	Ball Cactus	Cactaceae
<i>Opuntia compressa</i>	Prickly Pear Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae

Table 9.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CHEATGRASS/PERENNIAL GRASS TYPE ON THE ROCKY MOUNTAIN  
ARSENAL. BASED ON DATA FROM 67 SAMPLING LOCATIONS. 1986  
DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
Agropyron smithii	0.46	1.15	0 - 12	17.91	3.20	4.35	9
Agropyron trachycanlum	0.10	0.26	0 - 6	2.99	0.53	0.79	28
Aristida longiseta	1.31	3.26	0 - 17	28.36	5.07	8.33	3
Sitanion longifolium	0.15	0.37	0 - 0	5.97	1.07	1.44	21
Stipa comata	1.22	3.04	0 - 14	28.36	5.07	8.11	4
Sub-total	3.25	8.08					
<b>WARM SEASON PERENNIAL GRASSES</b>							
Bouteloua gracilis	0.22	0.56	0 - 8	7.46	1.33	1.89	18
Sporobolus cryptandrus	6.57	16.31	0 - 31	70.15	12.53	28.85	2
Sub-total	6.79	16.87					
<b>INTRODUCED PERENNIAL GRASSES</b>							
Agropyron desertorum	1.12	2.78	0 - 27	13.43	2.40	5.18	8
Bromopsis inermis	0.03	0.07	0 - 2	1.49	0.27	0.34	38
Poa pratensis	0.09	0.22	0 - 6	1.49	0.27	0.49	36
Sub-total	1.24	3.08					
<b>ANNUAL GRASSES</b>							
Bromus japonicus	0.09	0.22	0 - 3	2.09	0.53	0.76	29
Bromus tectorum	23.01	57.17	0 - 63	98.51	17.60	74.77	1
Vulpia octoflora	0.03	0.07	0 - 1	2.99	0.53	0.61	33
Sub-total	23.13	57.47					
<b>PERENNIAL FORBS</b>							
Ambrosia psilostachya	0.22	0.56	0 - 4	14.93	2.67	3.22	11
Aster falcatus	0.04	0.11	0 - 2	2.99	0.53	0.64	32

Table 9.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I. V.	Rank
<i>Cirsium arvense</i>	0.06	0.15	0 - 3	2.99	0.53	0.68	31
<i>Convolvulus arvensis</i>	1.21	3.00	0 - 19	28.36	5.07	8.07	5
<i>Erysimum asperum</i>	0.01	0.04	0 - 0	1.49	0.27	0.30	35
<i>Euphorbia esula</i>	0.01	0.04	0 - 0	1.49	0.27	0.30	35
<i>Evolvulus nuttallianus</i>	0.02	0.06	0 - 1	2.99	0.53	0.59	34
<i>Heterotheca villosa</i>	0.18	0.44	0 - 3	13.43	2.40	2.84	13
<i>Ipomoea leptophylla</i>	0.06	0.15	0 - 2	4.48	0.80	0.95	26
<i>Kuhnia eupatorioides</i>	0.06	0.15	0 - 4	1.49	0.27	0.41	37
<i>Lupinus argenteus</i>	0.01	0.04	0 - 0	1.49	0.27	0.30	35
<i>Lygodesmia juncea</i>	0.42	1.04	0 - 6	23.88	4.27	5.30	7
<i>Mentzelia nuda</i>	0.04	0.11	0 - 1	4.48	0.80	0.91	27
<i>Oenothera coronopifolia</i>	0.07	0.19	0 - 4	2.99	0.53	0.72	30
<i>Penstemon albidus</i>	<0.01	<0.01	0 - <1	1.49	0.27	0.29	39
<i>Phyla cuneifolia</i>	0.19	0.48	0 - 12	2.99	0.53	1.02	25
<i>Physalis hederacfolia</i>	0.15	0.37	0 - 3	8.96	1.60	1.97	17
<i>Physalis heterophylla</i>	0.09	0.22	0 - 2	7.46	1.33	1.56	20
<i>Physalis virginiana</i>	0.07	0.19	0 - 0	5.97	1.07	1.25	22
<i>Psoralea tenuiflora</i>	0.18	0.44	0 - 4	10.45	1.87	2.31	16
<i>Senecio tridenticulatus</i>	0.03	0.07	0 - 2	1.49	0.27	0.34	38
<i>Sphaeralcea coccinea</i>	0.15	0.37	0 - 2	11.34	2.13	2.50	15
<i>Tragopogon dubius</i>	0.15	0.37	0 - 4	4.48	0.80	1.17	23
<i>Verbascum thapsus</i>	0.18	0.44	0 - 3	11.94	2.13	2.58	14
Sub-total	3.64	9.05					
ANNUAL AND BIENNIAL FORBS							
<i>Amaranthus albus</i>	0.03	0.07	0 - 0	1.49	0.27	0.34	38
<i>Carduus nutans</i> ssp. <i>macrocephalus</i>	1.06	2.63	0 - 14	23.88	4.27	6.90	6
<i>Chenopodium album</i>	0.01	0.04	0 - 1	1.49	0.27	0.30	35
<i>Conyza canadensis</i>	0.01	0.04	0 - 1	1.49	0.27	0.30	35

Table 9.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Croton texensis</i>	0.03	0.07	0 - 0	2.99	0.53	0.61	33
<i>Descurainia richardsonii</i>	0.01	0.04	0 - 1	1.49	0.27	0.30	35
<i>Gaura parviflora</i>	0.12	0.30	0 - 3	4.48	0.80	1.10	24
<i>Helianthus petiolaris</i>	0.01	0.04	0 - 0	1.49	0.27	0.30	35
<i>Kochia iranica</i>	0.12	0.30	0 - 0	4.48	0.80	1.10	24
<i>Lactuca serriola</i>	0.27	0.67	0 - 0	14.93	2.67	3.33	10
<i>Lappula redowskii</i>	0.01	0.04	0 - 1	1.49	0.27	0.30	35
<i>Melilotus alba</i>	0.01	0.04	0 - 0	1.49	0.27	0.30	35
<i>Oenothera strigosa</i>	0.01	0.04	0 - 1	1.49	0.27	0.30	35
<i>Onopordum acanthium</i>	0.01	0.04	0 - 1	1.49	0.27	0.30	35
<i>Salsola iberica</i>	0.09	0.22	0 - 0	2.99	0.53	0.76	29
<i>Sisymbrium altissimum</i>	0.12	0.30	0 - 0	7.46	1.33	1.63	19
<i>Solanum triflorum</i>	0.03	0.07	0 - 0	1.49	0.27	0.34	38
<i>Verbena bracteata</i>	0.03	0.07	0 - 0	1.49	0.27	0.34	38
<i>Verbesina encelioides</i>	0.07	0.19	0 - 0	2.99	0.53	0.72	30
Sub-total	2.09	5.19					
SEMI-SHRUBS OR HALF-SHRUBS							
<i>Artemisia dracunculoides</i>	0.04	0.11	0 - 0	16.42	2.93	3.04	12
Sub-total	0.04	0.11					
SHRUBS							
<i>Artemisia filifolia</i>	0.01	0.04	0 - 0	1.49	0.27	0.30	35
Sub-total	0.01	0.04					
CACTI AND SUCCULENTS							
<i>Opuntia polyacantha</i>	0.01	0.04	0 - 0	1.49	0.27	0.30	35
<i>Yucca glauca</i>	0.03	0.07	0 - 0	2.99	0.53	0.61	33
Sub-total	0.04	0.11					

Table 9. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
SUM OF SPECIES COVER	40.25						
TOTAL VEGETATION	40.34 +/-	11.58					
LITTER/ROCK	55.79 +/-	11.33					
BARE SOIL	3.87 +/-	4.90					
TOTAL COVER	96.13 +/-	4.90					
Number of Species/sample	5.60						

Table 10 . HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE CHEATGRASS/PERENNIAL GRASS TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

HEIGHTS OF MAJOR SPECIES

SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
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COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS

Agropyron smithii	26	8	2
Aristida longiseta	17	2	5
Stipa comata	41		1

WARM SEASON PERENNIAL GRASSES

Bouteloua gracilis	13		1
Sporobolus cryptandrus	32	9	29

INTRODUCED PERENNIAL GRASSES

Agropyron desertorum	43	7	3
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ANNUAL GRASSES

Bromus tectorum	27	10	51
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PERENNIAL FORBS

Convolvulus arvensis	12		1
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ANNUAL AND BIENNIAL FORBS

Carduus nutans	77	14	13
Descurainia richardsonii	77		1
Gaura parviflora	81	39	3
Lactuca serriola	57		1
Sisymbrium altissimum	57		1

DENSITY OF WOODY SPECIES AND CACTI (Sample size = 56)

SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
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Artemisia filifolia	7	54
Chrysothamnus nauseosus	2	13
Coryphantha vivipara	2	13
Eriogonum effusum	45	249
Opuntia compressa	20	96
Opuntia polyacantha	48	262
Yucca glauca	41	270

TOTAL	165	457
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Table 11.

PRODUCTION SUMMARY FOR THE CHEATGRASS/PERENNIAL  
GRASS TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED  
ON 1986 DATA FROM 67 SAMPLING LOCATIONS. -/-  
VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	1.19	0.00 - 52.60	1.14
Aristida longiseta	2.53	0.00 - 42.13	2.43
Schedonnardus paniculatus	0.05	0.00 - 2.87	0.05
Stipa comata	9.06	0.00 - 200.83	8.70
Sub-total	12.83		12.31
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	0.19	0.00 - 12.79	0.19
Sporobolus cryptandrus	20.84	0.00 - 82.21	20.01
Sub-total	21.04		20.20
INTRODUCED PERENNIAL GRASSES			
Agropyron desertorum	1.61	0.00 - 41.08	1.54
ANNUAL GRASSES			
Bromus tectorum	42.90	0.00 - 369.57	41.18
Vulpia octoflora	0.00	0.00 - 0.17	0.00
Sub-total	42.90		41.19
PERENNIAL FORBS			
Ambrosia psilostachya	2.31	0.00 - 41.74	2.21
Aster falcatus	0.07	0.00 - 4.37	0.07
Convolvulus arvensis	1.78	0.00 - 38.89	1.71
Evolvulus nuttallianus	0.37	0.00 - 20.73	0.36
Heterotheca villosa	0.71	0.00 - 23.91	0.68
Lithospermum incisum	0.01	0.00 - 0.82	0.01
Lygodesmia juncea	3.46	0.00 - 48.07	3.32
Mentzelia nuda	0.17	0.00 - 11.17	0.16
Oenothera coronopifolia	0.07	0.00 - 4.57	0.07
Oxybaphus linearis	0.01	0.00 - 0.61	0.01
Physalis hederifolia	0.54	0.00 - 22.65	0.52
Physalis heterophylla	0.59	0.00 - 29.33	0.57
Psoralea tenuiflora	0.79	0.00 - 45.38	0.76
Senecio tridenticulatus	0.03	0.00 - 2.29	0.03
Sphaeralcea coccinea	1.43	0.00 - 42.35	1.38
Tragopogon dubius	0.53	0.00 - 30.06	0.51

ble 11.(cont'd).

PRODUCTION SUMMARY FOR THE CHEATGRASS/PERENNIAL  
GRASS TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED  
ON 1986 DATA FROM 67 SAMPLING LOCATIONS. +/-  
VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
Verbascum thapsus	0.68	0.00 - 31.90	0.65
Sub-total	13.55		13.01
ANNUAL AND BIENNIAL FORBS			
Amaranthus albus	0.01	0.00 - 0.54	0.01
Amaranthus retroflexus	0.00	0.00 - 0.03	0.00
Carduus nutans ssp.macrolepis	4.46	0.00 - 100.35	4.28
Chamaesyce serpyllifolia	0.01	0.00 - 0.43	0.01
Chenopodium leptophyllum	0.00	0.00 - 0.05	0.00
Cirsium canescens	0.00	0.00 - 0.31	0.00
Conyza canadensis	0.16	0.00 - 5.54	0.15
Croton texensis	0.02	0.00 - 0.47	0.02
Descurainia richardsonii	0.15	0.00 - 9.72	0.15
Erigeron divergens	0.15	0.00 - 8.18	0.14
Eriogonum annuum	0.01	0.00 - 0.35	0.01
Gaura parviflora	1.79	0.00 - 91.80	1.72
Iva xanthifolia	1.22	0.00 - 81.98	1.17
Lactuca serriola	2.65	0.00 - 56.53	2.55
Lepidium densiflorum	0.01	0.00 - 0.44	0.01
Oenothera albicaulis	0.01	0.00 - 0.81	0.01
Plantago patagonica	0.01	0.00 - 0.36	0.01
Salsola iberica	0.06	0.00 - 3.56	0.06
Sisymbrium altissimum	0.04	0.00 - 2.27	0.03
Solanum triflorum	0.00	0.00 - 0.03	0.00
Verbesina encelioides	1.48	0.00 - 99.28	1.42
Sub-total	12.24		11.75
TOTAL PRODUCTION	104.18	+/- 63.88	



Table 12.

LIST OF SPECIES OBSERVED GROWING IN THE  
CHEATGRASS/PERENNIAL GRASS TYPE AT THE ROCKY MOUNTAIN  
ARSENAL. BASED ON OBSERVATIONS MADE DURING THE 1986 GROWING  
SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Hordeum jubatum</i>	Foxtail Barley	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Calamovilfa longifolia</i>	Prairie Sandreed	Gramineae
<i>Sporobolus airoides</i>	Alkali Sacaton	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Abronia fragrans</i>	Sand Verbena	Nyctaginaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Antennaria rosea</i>	Pussytoes	Compositae
<i>Apocynum sibiricum</i>	Siberian Dogbane	Apocynaceae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias pumilus</i>	Little Milkweed	Asclepiadaceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Asclepias subverticillata</i>	Whorled Milkweed	Asclepiadaceae
<i>Asclepias uncialis</i>	Dwarf Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae

Table 12.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Hypericum perforatum</i>	Klamath Weed	Hypericaceae
<i>Ipomoea leptophylla</i>	Bush Morning Glory	Convolvulaceae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Liatris punctata</i>	Gay Feather	Compositae
<i>Lithospermum incisum</i>	Narrowleaf Gromwell	Boraginaceae
<i>Lupinus argenteus</i>	Silvery Lupine	Leguminosae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Penstemon albidus</i>	White Beardtongue	Scrophulariaceae
<i>Phyla cuneifolia</i>	Fog Fruit	Verbenaceae
<i>Physalis hederifolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Rumex crispus</i>	Curly Dock	Polygonaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Taraxacum officinale</i>	Common Dandelion	Compositae
<i>Thelesperma megapotamicum</i>	Thelesperma	Compositae
<i>Tradescantia occidentalis</i>	Spiderwort	Commelinaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<i>Vicia villosa</i>	Woolly Vetch	Leguminosae
ANNUAL AND BIENNIAL FORBS		
<i>Alyssum desertorum</i>	Desert Alyssum	Cruciferae
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Amaranthus graecizans</i>	Prostrate Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae

Table 12.(cont'd.)

Scientific Name	Common Name	Family Name
Chrysothamnus nauseosus	Rubber Rabbitbrush	Compositae
Eriogonum effusum	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
Coryphantha vivipara	Ball Cactus	Cactaceae
Opuntia compressa	Prickly Pear Cactus	Cactaceae
Opuntia polyacantha	Plains Prickly Pear	Cactaceae
Yucca glauca	Spanish Bayonet	Agavaceae

Table 13.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE NATIVE PERENNIAL GRASS TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON 1986 DATA FROM 73 SAMPLING SITES. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I. V.	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
<i>Agropyron smithii</i>	1.78	5.14	0 - 0	21.92	3.23	8.38	7
<i>Aristida longiset</i>	3.75	10.84	0 - 0	38.36	5.66	16.50	5
<i>Schedonardus paniculatus</i>	0.05	0.16	0 - 0	4.11	0.61	0.76	34
<i>Sitacion longifolium</i>	0.48	1.39	0 - 0	21.92	3.23	4.62	9
<i>Stipa comata</i>	3.84	11.08	0 - 0	41.10	6.06	17.14	4
Sub-total	9.90	28.61					
<b>WARM SEASON PERENNIAL GRASSES</b>							
<i>Houtelona gracilis</i>	6.10	17.61	0 - 0	49.32	7.27	24.88	2
<i>Buchloe dactyloides</i>	0.11	0.32	0 - 0	4.11	0.61	0.92	31
<i>Calamovilfa longifolia</i>	0.05	0.16	0 - 0	1.37	0.20	0.36	39
<i>Muhlenbergia torreyi</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Sporobolus cryptandrus</i>	3.73	10.76	0 - 0	56.16	8.28	19.05	3
Sub-total	10.00	28.89					
<b>INTRODUCED PERENNIAL GRASSES</b>							
<i>Agropyron desertorum</i>	0.25	0.71	0 - 0	4.11	0.61	1.32	26
<i>Poa pratensis</i>	0.05	0.16	0 - 0	1.37	0.20	0.36	39
Sub total	0.30	0.87					
<b>ANNUAL GRASSES</b>							
<i>Bromus japonicus</i>	0.34	0.99	0 - 0	1.37	0.20	1.19	27
<i>Bromus tectorum</i>	6.95	20.06	0 - 0	64.38	9.49	29.56	1
<i>Vulpia octoflora</i>	0.04	0.12	0 - 0	2.74	0.40	0.52	37
Sub-total	7.33	21.17					
<b>PERENNIAL FORBS</b>							
<i>Ambrosia psilostachya</i>	0.95	2.73	0 - 0	39.73	5.86	8.59	6

Table 13 (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I. V.	Rank
<i>Argemone polyanthemus</i>	<0.01	<0.01	0 -	<1	39.73	5.86	8
<i>Aster falcatus</i>	0.07	0.20	0 -	0	5.48	1.01	30
<i>Cirsium undulatum</i>	6.03	0.08	0 -	0	2.74	0.48	38
<i>Convolvulus arvensis</i>	0.49	1.42	0 -	0	12.33	3.24	15
<i>Erysimum asperum</i>	0.04	0.12	0 -	0	2.74	0.52	37
<i>Evolvulus nuttallianus</i>	0.19	0.55	0 -	0	12.33	2.37	18
<i>Heterotheca villosa</i>	0.33	0.95	0 -	0	9.59	2.36	19
<i>Ipomoea leptophylla</i>	0.04	0.12	0 -	0	1.37	0.32	40
<i>Kuhnia eupatorioides</i>	0.07	0.20	0 -	0	2.74	0.60	36
<i>Lupinus argenteus</i>	0.01	0.04	0 -	0	1.37	0.24	42
<i>Lygodesmia juncea</i>	0.49	1.42	0 -	0	17.81	4.05	12
<i>Mentzelia nuda</i>	0.32	0.91	0 -	0	20.55	3.94	14
<i>Oenothera coronopifolia</i>	0.12	0.36	0 -	0	8.22	1.57	23
<i>Physalis hederacifolia</i>	0.26	0.75	0 -	0	15.07	2.97	16
<i>Physalis heterophylla</i>	0.10	0.28	0 -	0	8.22	1.49	25
<i>Psoralea tenuiflora</i>	0.26	0.75	0 -	0	21.92	3.98	13
<i>Senecio spartioides</i>	0.04	0.12	0 -	0	2.74	0.52	37
<i>Senecio tridenticulatus</i>	0.10	0.28	0 -	0	4.11	0.80	32
<i>Sphaeralcea coccinea</i>	0.47	1.35	0 -	0	21.92	4.58	10
<i>Tradescantia occidentalis</i>	0.01	0.04	0 -	0	1.37	0.24	42
Sub-total	4.38	12.66					
ANNUAL AND BIENNIAL FORBS							
<i>Amaranthus albus</i>	0.01	0.04	0 -	0	1.37	0.24	42
<i>Chamaesyce glyptosperma</i>	<0.01	<0.01	0 -	<1	1.37	0.20	43
<i>Chamaesyce serpyllifolia</i>	0.01	0.04	0 -	0	1.37	0.24	42
<i>Chenopodium album</i>	0.03	0.08	0 -	0	2.74	0.48	38
<i>Cniza canadensis</i>	0.04	0.12	0 -	0	4.11	0.72	35
<i>Croton texensis</i>	0.04	0.12	0 -	0	4.11	0.72	35

Table 13. - (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Cryptantha fendleri</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Cryptantha minima</i>	0.26	0.75	0 - 0	9.59	1.41	2.17	20
<i>Descurainia richardsonii</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Eriogonum annuum</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Helfanthus petiolaris</i>	0.14	0.40	0 - 0	9.59	1.41	1.81	22
<i>Iva xanthifolia</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Kochia iranica</i>	0.40	1.15	0 - 0	9.59	1.41	2.56	17
<i>Lactuca serriola</i>	0.52	1.50	0 - 0	19.18	2.83	4.33	11
<i>Lappula redowskii</i>	0.08	0.24	0 - 0	4.11	0.61	0.84	33
<i>Plantago patagonica</i>	0.11	0.32	0 - 0	5.48	0.81	1.12	28
<i>Polygonum ramocissifolium</i>	0.05	0.16	0 - 0	4.11	0.61	0.76	34
<i>Salsola iberica</i>	0.25	0.71	0 - 0	5.48	0.81	1.52	24
<i>Sisymbrium altissimum</i>	0.47	1.35	0 - 0	5.48	0.81	2.15	21
Sub-total	2.47	7.12					
SEMI-SHRUBS OR HALF-SHRUBS							
<i>Artemisia dracunculifolia</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Artemisia frigida</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Gutierrezia sarothrae</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
Sub-total	0.04	0.12					
SHRUBS							
<i>Chrysothamnus nauseosus</i>	0.04	0.12	0 - 0	4.11	0.61	0.72	35
<i>Eriogonum effusum</i>	0.08	0.24	0 - 0	5.48	0.81	1.05	29
Sub-total	0.12	0.36					
CACTI AND SUCCULENTS							
<i>Opuntia compressa</i>	0.01	0.04	0 - 0	1.37	0.20	0.24	42
<i>Opuntia polyacantha</i>	0.03	0.08	0 - 0	1.37	0.20	0.28	41

Table 13. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Yucca glauca</i>	0.03	0.08	0 - 0	2.74	0.40	0.48	38
Sub total	0.07	0.20					
SUM OF SPECIES COVER	34.62						
TOTAL VEGETATION	34.49 +/-	11.96					
LITTER/ROCK	56.75 +/-	10.09					
BARE SOIL	8.75 +/-	8.36					
TOTAL COVER	91.25 +/-	8.36					
Number of Species/sample	6.78						

Table 14. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE NATIVE PERENNIAL GRASS TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

HEIGHTS OF MAJOR SPECIES			
SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
<i>Agropyron smithii</i>	14	4	10
<i>Aristida longiseta</i>	20	4	18
<i>Sitanion longifolium</i>	20	3	5
<i>Stipa comata</i>	39	7	13
WARM SEASON PERENNIAL GRASSES			
<i>Bouteloua gracilis</i>	8	4	4
<i>Sporobolus cryptandrus</i>	30	8	30
INTRODUCED PERENNIAL GRASSES			
<i>Agropyron desertorum</i>	55		1
ANNUAL GRASSES			
<i>Bromus tectorum</i>	24	6	27
PERENNIAL FORBS			
<i>Ambrosia psilostachya</i>	18	2	3
<i>Lygodesmia juncea</i>	23	2	2
<i>Mentzelia nuda</i>	44	13	8
<i>Psoralea tenuiflora</i>	34	9	3
<i>Senecio tridenticulatus</i>	9		1
<i>Sphaeralcea coccinea</i>	9		1
ANNUAL AND BIENNIAL FORBS			
<i>Eriogonum annuum</i>	40	3	4
<i>Kochia iranica</i>	8	5	2
<i>Lactuca serriola</i>	13		1
<i>Sisymbrium altissimum</i>	64		1
SEMI-SHRUBS			
<i>Artemisia dracunculus</i>	43		1
SHRUBS			
<i>Ceratoides lanata</i>	21		1
<i>Chrysothamnus nauseosus</i>	28		1
<i>Eriogonum effusum</i>	16		1



Table 14. (CONT'D)

DENSITY OF WOODY SPECIES AND CACTI (Sample size = 73)		
SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
<i>Artemisia filifolia</i>	3	16
<i>Ceratoides lanata</i>	8	52
<i>Chrysothamnus nauseosus</i>	48	232
<i>Coryphantha vivipara</i>	12	64
<i>Eriogonum effusum</i>	156	708
<i>Opuntia compressa</i>	111 ~	260
<i>Opuntia polyacantha</i>	229 -	1100
<i>Yucca glauca</i>	36	174
TOTAL	603	1504

NO TABLE 15

Table 16.

PRODUCTION SUMMARY FOR THE NATIVE PERENNIAL GRASS  
TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON 1986  
DATA FROM 73 SAMPLING SITES. +/- VALUES EQUAL THE  
STANDARD DEVIATION.

Species	Mean (g/sq.m)	Range of Production Values (g/sq.m)	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	7.83	0.00 -172.91	8.24
Aristida longiseta	11.60	0.00 - 95.43	12.20
Schedonnardus paniculatus	0.05	0.00 - 2.02	0.05
Sitanion longifolium	0.72	0.00 - 25.12	0.76
Stipa comata	16.67	0.00 -166.15	17.53
Sub-total	36.87		38.78
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	10.06	0.00 -104.43	10.58
Sporobolus cryptandrus	8.82	0.00 - 74.73	9.27
Sub-total	18.88		19.86
INTRODUCED PERENNIAL GRASSES			
Agropyron desertorum	2.17	0.00 - 94.96	2.28
ANNUAL GRASSES			
Bromus japonicus	0.03	0.00 - 2.24	0.03
Bromus tectorum	13.09	0.00 -124.45	13.76
Hordeum pusillum	0.01	0.00 - 1.00	0.01
Munroa squarrosa	0.02	0.00 - 1.46	0.02
Vulpia octoflora	0.09	0.00 - 4.35	0.10
Sub-total	13.25		13.93
PERENNIAL FORBS			
Ambrosia psilostachya	2.72	0.00 - 51.68	2.86
Argemone polyanthemos	0.04	0.00 - 1.44	0.04
Aster falcatus	1.09	0.00 - 38.87	1.14
Cardaria draba	<0.01	0.00 - 0.03	0.00
Cirsium arvense	0.71	0.00 - 51.13	0.75
Comandra umbellata	0.02	0.00 - 0.74	0.02
Convolvulus arvensis	1.48	0.00 - 60.15	1.56
Evolvulus nuttallianus	0.36	0.00 - 15.26	0.38
Gaura coccinea	0.03	0.00 - 2.39	0.03
Grindelia squarrosa	0.03	0.00 - 2.16	0.03
Heterotheca villosa	0.13	0.00 - 4.26	0.14

Table 16. (cont'd)

Species	Mean (g/sq.m)	Range of Production Values (g/sq.m)	Percent of Total Production
<i>Ipomoea leptophylla</i>	0.39	0.00 - 28.12	0.41
<i>Lithospermum incisum</i>	0.01	0.00 - 0.38	0.01
<i>Lygodesmia juncea</i>	1.38	0.00 - 26.86	1.45
<i>Mentzelia nuda</i>	2.09	0.00 - 68.55	2.19
<i>Oenothera coronopifolia</i>	0.24	0.00 - 4.64	0.26
<i>Physalis hederæfolia</i>	0.04	0.00 - 2.95	0.04
<i>Physalis heterophylla</i>	0.79	0.00 - 50.28	0.83
<i>Psoralea tenuiflora</i>	0.62	0.00 - 24.26	0.65
<i>Senecio tridenticulatus</i>	0.60	0.00 - 29.95	0.63
<i>Sphaeralcea coccinea</i>	1.59	0.00 - 40.55	1.67
Sub-total	14.35		15.09
ANNUAL AND BIENNIAL FORBS			
<i>Amaranthus albus</i>	<0.01	0.00 - 0.11	0.00
<i>Chamaesyce glyptosperma</i>	0.03	0.00 - 0.54	0.03
<i>Chamaesyce serpyllifolia</i>	0.03	0.00 - 1.96	0.03
<i>Chenopodium leptophyllum</i>	0.44	0.00 - 8.07	0.46
<i>Conyza canadensis</i>	0.50	0.00 - 11.31	0.52
<i>Croton texensis</i>	0.07	0.00 - 2.13	0.07
<i>Cryptantha minima</i>	0.25	0.00 - 9.14	0.26
<i>Descurainia richardsonii</i>	0.02	0.00 - 1.30	0.02
<i>Erigeron divergens</i>	0.02	0.00 - 1.73	0.03
<i>Eriogonum annuum</i>	0.05	0.00 - 1.23	0.06
<i>Gaura parviflora</i>	0.01	0.00 - 1.03	0.02
<i>Helianthus petiolaris</i>	0.97	0.00 - 16.66	1.02
<i>Kochia iranica</i>	0.88	0.00 - 25.52	0.92
<i>Lactuca serriola</i>	2.25	0.00 - 35.95	2.37
<i>Lappula redowskii</i>	0.41	0.00 - 22.74	0.43
<i>Lepidium densiflorum</i>	0.11	0.00 - 2.07	0.12
<i>Plantago patagonica</i>	0.25	0.00 - 10.61	0.26
<i>Polygonum aviculare</i>	0.54	0.00 - 33.16	0.57
<i>Salsola iberica</i>	0.25	0.00 - 11.26	0.26
<i>Sisymbrium altissimum</i>	1.93	0.00 - 118.73	2.02
<i>Solanum triflorum</i>	0.44	0.00 - 31.04	0.46
<i>Verbena bracteata</i>	0.02	0.00 - 1.44	0.02
<i>Verbesina encelioides</i>	<0.01	0.00 - 0.04	0.00
Sub-total	9.47		9.96
SHRUBS			
<i>Eriogonum effusum</i>	0.09	0.00 - 5.34	0.09
TOTAL PRODUCTION		96.68+/- 43.94	

Table 17.

LIST OF SPECIES OBSERVED GROWING IN THE NATIVE PERENNIAL  
GRASS TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON  
OBSERVATIONS MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Aristida fendleriana</i>	Fendler Three-awn	Gramineae
<i>Carex heliophila</i>	Sun Sedge	Cyperaceae
<i>Carex praeegracilis</i>	Sedge	Cyperaceae
<i>Carex</i> sp.	Sedge	Cyperaceae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Hordeum jubatum</i>	Foxtail Barley	Gramineae
<i>Oryzopsis hymenoides</i>	Indian Ricegrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Andropogon hallii</i>	Sandhills Bluestem	Gramineae
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Calamovilfa longifolia</i>	Prairie Sandreed	Gramineae
<i>Muhlenbergia torreyi</i>	Ring Muhly	Gramineae
<i>Panicum virgatum</i>	Switchgrass	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Eragrostis cilianensis</i>	Stinking Lovegrass	Gramineae
<i>Hordeum pusillum</i>	Little Barley	Gramineae
<i>Munroa squarrosa</i>	False Buffalo Grass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Secale cereale</i>	Rye	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Abronia fragrans</i>	Sand Verbena	Nyctaginaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Ambrosia tomentosa</i>	Spiny Bursage	Compositae
<i>Anaphalis margaritacea</i>	Pearly Everlasting	Compositae
<i>Antennaria rosea</i>	Pussytoes	Compositae
<i>Apocynum sibiricum</i>	Siberian Dogbane	Apocynaceae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae

Table 17.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Asclepias viridiflora</i>	Green Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus bisulcatus</i>	Two-grooved Milkvetch	Leguminosae
<i>Astragalus ceramicus</i>	Potsherd Milk Vetch	Leguminosae
<i>Astragalus crassicaupus</i>	Ground Plum	Leguminosae
<i>Astragalus missouriensis</i>	Missouri Milkvetch	Leguminosae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Comandra umbellata</i>	Bastard Toadflax	Santalaceae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Daisy Fleabane	Compositae
<i>Erysimum asperum</i>	Western Wallflower	Cruciferae
<i>Euphorbia esula</i>	Leafy Spurge	Euphorbiaceae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Hypericum perforatum</i>	Klamath Weed	Hypericaceae
<i>Ipomoea leptophylla</i>	Bush Morning Glory	Convolvulaceae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Lesquerella ludoviciana</i>	Bladderpod	Cruciferae
<i>Leucocrinum montanum</i>	Sand Lily	Liliaceae
<i>Lithospermum incisum</i>	Narrowleaf Gronwell	Boraginaceae
<i>Liatris punctata</i>	Gay Feather	Compositae
<i>Lomatium orientale</i>	Salt and Pepper	Umbelliferae
<i>Lupinus argenteus</i>	Silvery Lupine	Leguminosae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Monarda pectinata</i>	Horesmint	Labiatae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Oenothera nuttallii</i>	Nuttall Evening Primrose	Onagraceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Oxybaphus nyctagineus</i>	Heart-leaved Umbrella Wort	Nyctaginaceae
<i>Oxytropis lambertii</i>	Locoweed	Leguminosae
<i>Penstemon albidus</i>	White Beardtongue	Scrophulariaceae
<i>Penstemon angustifolia</i>	Narrowleaf Beardtongue	Scrophulariaceae
<i>Petalostemon compactus</i>	Compact Prairie Clover	Leguminosae
<i>Physalis hederifolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Psoralea lanceolata</i>	Narrowleaf Scurfpea	Leguminosae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Ratibida columnifera</i>	Prairie Coneflower	Compositae
<i>Rumex venosus</i>	Veiny Dock	Polygonaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae

Table 17.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Solidago mollis</i>	Soft Goldenrod	Compositae
<i>Sophora nuttalliana</i>	Sophora	Leguminosae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Thelesperma megapotamicum</i>	Thelesperma	Compositae
<i>Tradescantia occidentalis</i>	Spiderwort	Commelinaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<i>Zygadenus venenosus</i>	Death Camas	Liliaceae
ANNUAL AND BIENNIAL FORBS		
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Amaranthus arenicola</i>	Sand Pigweed	Amaranthaceae
<i>Amaranthus graecizans</i>	Prostrate Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Ambrosia acanthicarpa</i>	Sand-bur	Compositae
<i>Artemisia biennis</i>	Biennial Wormwood	Compositae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Cleome serrulata</i>	Rocky Mt. Bee Plant	Capparidaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Cryptantha fendleri</i>	Fendler Cryptantha	Boraginaceae
<i>Cryptantha minima</i>	Small Cryptantha	Boraginaceae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Descurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Draba reptans</i>	White Draba	Cruciferae
<i>Dysodia papposa</i>	Fetid Marigold	Compositae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>Euphorbia spathulata</i>	Spurge	Euphorbiaceae
<i>Evax prolifera</i>	Fluffweed	Compositae
<i>Fallopia convolvulus</i>	Black Bindweed	Polygonaceae
<i>Froelichia gracilis</i>	Froelichia	Amaranthaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Gayophytum ramosissimum</i>	Ground Smoke	Onagraceae
<i>Hedeoma hispidum</i>	False Pennyroyal	Labiatae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Helianthus petiolaris</i>	Prairie Sunflower	Compositae
<i>Ipomopsis laxiflora</i>	Gilia	Polemoniaceae
<i>Iva xanthifolia</i>	Marsh Elder	Compositae

Table 17. (cont'd.)

Scientific Name	Common Name	Family Name
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lappula redowskii</i>	Beggars-tick	Boraginaceae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Myosurus minimus</i>	Mousetail	Ranunculaceae
<i>Oenothera albicaulis</i>	Prairie Evening Primrose	Onagraceae
<i>Oenothera strigosa</i>	Evening Primrose	Onagraceae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Polygonum ramocissium</i>	Branched Knotweed	Polygonaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia dracunculus</i>	Green Sage	Compositae
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
<i>Gutierrezia sarothrae</i>	Broom Snakeweed	Compositae
SHRUBS		
<i>Artemisia filifolia</i>	Sand Sage	Compositae
<i>Ceratoides lanata</i>	Winterfat	Chenopodiaceae
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Clematis ligusticifolia</i>	Western Virgin's Bower	Ranunculaceae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
<i>Prunus americana</i>	Wild Plum	Rosaceae
<i>Ribes aureum</i>	Golden Currant	Grossulariaceae
<i>Rosa arkansana</i>	Prairie Rose	Rosaceae
CACTI AND SUCCULENTS		
<i>Coryphantha vivipara</i>	Ball Cactus	Cactaceae
<i>Opuntia compressa</i>	Prickly Pear Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae



Table 18.

COVER: FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CRESTED WHEATGRASS TYPE ON THE ROCKY MOUNTAIN ARSENAL.  
BASED ON DATA FROM 50 SAMPLING LOCATIONS. 1986 DATA. +/-  
VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron smithii	0.15	0.51	0 - 3	8.33	2.30	2.81	9
Agropyron trachycaulum	0.04	0.15	0 - 2	2.08	0.57	0.72	19
Aristida longiseta	0.19	0.66	0 - 4	12.50	3.45	4.11	7
Elymus canadensis	0.06	0.22	0 - 3	2.08	0.57	0.79	18
Stipa comata	0.15	0.51	0 - 4	6.25	1.72	2.24	11
Sub-total	0.58	2.05					
WARM SEASON PERENNIAL GRASSES							
Sporobolus cryptandrus	1.23	4.32	0 - 8	37.50	10.34	14.66	3
Sub-total	1.23	4.32					
INTRODUCED PERENNIAL GRASSES							
Agropyron desertorum	20.46	71.89	0 - 34	100.00	27.59	99.47	1
Bromopsis inermis	0.02	0.07	0 - 1	2.08	0.57	0.65	20
Sub-total	20.48	71.96					
ANNUAL GRASSES							
Bromus japonicus	0.08	0.29	0 - 4	2.08	0.57	0.87	17
Bromus tectorum	3.94	13.84	0 - 27	54.17	14.94	28.78	2
Sub-total	4.02	14.13					
PERENNIAL FORBS							
Ambrosia psilostachya	0.23	0.81	0 - 3	14.58	4.02	4.83	6
Apocynum sibiricum	0.02	0.07	0 - 1	2.08	0.57	0.65	20
Asclepias speciosa	0.02	0.07	0 - 1	2.08	0.57	0.65	20
Cardaria draba	0.10	0.37	0 - 5	2.08	0.57	0.94	16
Convolvulus arvensis	0.40	1.39	0 - 5	18.75	5.17	6.56	4

Table 18 . (cont'd) .

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Heterotheca villosa</i>	0.08	0.29	0 - 1	8.33	2.30	2.59	10
<i>Ipomoea leptophylla</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Kuhnia eupatorioides</i>	0.04	0.15	0 - 1	4.17	1.15	1.30	15
<i>Lygodesmia juncea</i>	0.17	0.59	0 - 2	12.50	3.45	4.03	8
<i>Oenothera coronopifolia</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Physalis hederifolia</i>	0.10	0.37	0 - 4	4.17	1.15	1.52	14
<i>Physalis heterophylla</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Psoralea tenuiflora</i>	0.04	0.15	0 - 1	4.17	1.15	1.30	15
<i>Sphaeralcea coccinea</i>	0.06	0.22	0 - 1	6.25	1.72	1.94	13
<i>Tragopogon dubius</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
Sub-total	1.35	4.76					
ANNUAL AND BIENNIAL FORBS							
<i>Chenopodium album</i>	0.04	0.15	0 - 2	2.08	0.57	0.72	19
<i>Conyza canadensis</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Descurainia richardsonii</i>	0.04	0.15	0 - 2	2.08	0.57	0.72	19
<i>Erigeron divergens</i>	0.04	0.15	0 - 2	2.08	0.57	0.72	19
<i>Eriogonum annuum</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Kochia iranica</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Lactuca serriola</i>	0.35	1.24	0 - 6	16.67	4.60	5.84	5
<i>Lepidium densiflorum</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Salsola iberica</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Sisymbrium altissimum</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
<i>Verbesina encelioides</i>	0.02	0.07	0 - 1	2.08	0.57	0.65	20
Sub-total	0.62	2.20					
SHRUBS							
<i>Chrysothamnus nauseosus</i>	0.06	0.22	0 - 3	2.08	0.57	0.79	18
Sub-total	0.06	0.22					

Table 18 . (cont 'd) .

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I.V.	Rank
CACTI AND SUCCULENTS							
Opuntia compressa	0.02	0.07	0 - 1	2.08	0.57	0.65	26
Yucca glauca	0.08	0.29	0 - 2	6.25	1.72	2.02	12
Sub-total	0.10	0.37					
SUM OF SPECIES COVER	28.46						
MOSSES	0.08		0 - 4	2.08			
LITTER	66.77		0 - 0	100.00			
TOTAL VEGETATION	28.54 +/-	6.69					
LITTER/ROCK	66.77 +/-	9.21					
BAKE SOIL	4.69 +/-	6.51					
TOTAL COVER	95.31 +/-	6.51					
Number of Species/sample	3.63						

Table 19 . HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE CRESTED WHEATGRASS TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
<i>Aristida longiseta</i>	18		1
WARM SEASON PERENNIAL GRASSES			
<i>Sporobolus cryptandrus</i>	29	6	3
INTRODUCED PERENNIAL GRASSES			
<i>Agropyron desertorum</i>	42	7	47
ANNUAL GRASSES			
<i>Bromus tectorum</i>	28	8	5
ANNUAL AND BIENNIAL FORBS			
<i>Carduus nutans</i>	49		1
<i>Lactuca serriola</i>	52		1
SHRUBS			
<i>Chrysothamnus nauseosus</i>	61		1

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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 50)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
<i>Chrysothamnus nauseosus</i>	26	184
<i>Opuntia compressa</i>	14	73
<i>Opuntia polyacantha</i>	40	120
<i>Yucca glauca</i>	46	169
TOTAL	126	292

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110 20.

PRODUCTION SUMMARY FOR THE CRESTED WHEATGRASS  
TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON 1986  
DATA FROM 50 SAMPLING LOCATIONS. +/- VALUES EQUAL  
THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Aristida longiseta	0.09	0.00 - 2.06	0.09
Stipa comata	0.04	0.00 - 1.69	0.04
Sub-total	0.13		0.13
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	0.05	0.00 - 1.15	0.05
Sporobolus cryptandrus	2.65	0.00 - 41.96	2.65
Sub-total	2.69		2.70
INTRODUCED PERENNIAL GRASSES			
Agropyron desertorum	82.59	0.00 - 200.83	82.85
ANNUAL GRASSES			
Bromus tectorum	4.34	0.00 - 73.83	4.36
Vulpia octoflora	0.00	0.00 - 0.04	0.00
Sub-total	4.34		4.36
PERENNIAL FORBS			
Ambrosia psilostachya	1.64	0.00 - 51.16	1.65
Asclepias speciosa	0.42	0.00 - 20.04	0.42
Aster falcatus	0.01	0.00 - 0.65	0.01
Convolvulus arvensis	0.08	0.00 - 3.62	0.08
Grindelia squarrosa	0.01	0.00 - 0.71	0.01
Heterotheca villosa	0.01	0.00 - 0.61	0.01
Lygodesmia juncea	0.74	0.00 - 10.84	0.75
Mentzelia nuda	0.18	0.00 - 8.81	0.18
Oenothera coronopifolia	0.05	0.00 - 2.34	0.05
Physalis hederifolia	0.58	0.00 - 27.42	0.58
Sphaeralcea coccinea	0.69	0.00 - 11.64	0.69
Sub-total	4.42		4.44
ANNUAL AND BIENNIAL FORBS			
Chamaesyce glyptosperma	0.32	0.00 - 15.39	0.32
Chamaesyce serpyllifolia	0.12	0.00 - 5.96	0.12
Chenopodium leptophyllum	0.12	0.00 - 3.01	0.12
Conyza canadensis	0.63	0.00 - 12.24	0.63

le 20.(cont'd).

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
Erigeron divergens	2.63	0.00 - 72.29	2.64
Gaura parviflora	0.20	0.00 - 9.63	0.20
Kochia iranica	0.02	0.00 - 0.83	0.02
Lactuca serriola	1.46	0.00 - 62.23	1.46
Lepidium densiflorum	0.01	0.00 - 0.21	0.01
Polygonum aviculare	0.00	0.00 - 0.06	0.00
Sub-total	5.51		5.53
TOTAL PRODUCTION	99.69 +/- 38.82		

Table 21.

LIST OF SPECIES OBSERVED IN THE CRESTED WHEATGRASS TYPE AT  
THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS MADE  
DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Eleocharis acicularis</i>	Slender Spikerush	Cyperaceae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Calamovilfa longifolia</i>	Prairie Sandreed	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Hordeum pusillum</i>	Little Barley	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Antennaria rosea</i>	Pussytoes	Compositae
<i>Apocynum sibiricum</i>	Siberian Dogbane	Apocynaceae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Asclepias viridiflora</i>	Green Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus missouriensis</i>	Missouri Milkvetch	Leguminosae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Centaurea repens</i>	Russian Knapweed	Compositae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae

Scientific Name	Common Name	Family Name
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Ipomoea leptophylla</i>	Bush Morning Glory	Convolvulaceae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Lupinus argenteus</i>	Silvery Lupine	Leguminosae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Physalis hederifolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridentatus</i>	Groundsel	Compositae
<i>Solidago missouriensis</i>	Missouri Goldenrod	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Tradescantia occidentalis</i>	Spiderwort	Commelinaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
ANNUAL AND BIENNIAL FORBS		
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Amaranthus arenicola</i>	Sand Pigweed	Amaranthaceae
<i>Amaranthus graecizans</i>	Prostrate Pigweed	Amaranthaceae
<i>Ambrosia acanthicarpa</i>	Sand-bur	Compositae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Cleome serrulata</i>	Rocky Mt. Bee Plant	Capparidaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Descurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae



Table 21 .(cont'd.)

Scientific Name	Common Name	Family Name
<i>Helianthus petiolaris</i>	Prairie Sunflower	Compositae
<i>Iva xanthifolia</i>	Marsh Elder	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lappula redowskii</i>	Beggars-tick	Boraginaceae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Lupinus pusillus</i>	Rusty Lupine	Leguminosae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Oenothera albicaulis</i>	Prairie Evening Primrose	Onagraceae
<i>Oenothera strigosa</i>	Evening Primrose	Onagraceae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia dracunculus</i>	Green Sage	Compositae
SHRUBS		
<i>Artemisia filifolia</i>	Sand Sage	Compositae
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
<i>Opuntia compressa</i>	Prickly Pear Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae
TREES		
<i>Juniperus scopulorum</i>	Rocky Mtn. Juniper	Cupressaceae

Table 22.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE SAND  
SAGEBRUSH SHRUBLAND TYPE ON THE ROCKY MOUNTAIN ARSENAL.  
BASED ON DATA FROM 12 SAMPLING LOCATIONS. +/- VALUES EQUAL  
THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron riparium	0.15	0.22	0 - 0	7.69	1.37	1.59	12
Agropyron smithii	0.08	0.11	0 - 0	7.69	1.37	1.48	13
Aristida longiseta	0.31	0.43	0 - 4	7.69	1.37	1.80	11
Carex filifolia	0.92	1.30	0 - 12	7.69	1.37	2.67	10
Stipa comata	14.00	19.76	0 - 52	76.92	13.70	33.46	3
Sub-total	15.46	21.82					
WARM SEASON PERENNIAL GRASSES							
Bouteloua gracilis	0.85	1.19	0 - 6	30.77	5.48	6.67	7
Calamovilfa longifolia	4.77	6.73	0 - 14	61.54	10.96	17.69	5
Sporobolus cryptandrus	0.15	0.22	0 - 0	7.69	1.37	1.59	12
Sub-total	5.77	8.14					
INTRODUCED PERENNIAL GRASSES							
Agropyron desertorum	3.85	5.43	0 - 46	15.38	2.74	8.17	6
Sub-total	3.85	5.43					
ANNUAL GRASSES							
Bromus tectorum	15.54	21.93	0 - 46	76.92	13.70	35.63	2
Vulpia octoflora	0.08	0.11	0 - 0	7.69	1.37	1.48	13
Sub-total	15.62	22.04					
PERENNIAL FORBS							
Ambrosia psilostachya	0.01	0.02	0 - 0	100.00	17.81	17.82	4
Sphaeralcea coccinea	0.46	0.65	0 - 4	15.38	2.74	3.39	9
Thelesperma megapotaemicum	0.15	0.22	0 - 2	7.69	1.37	1.59	12
Sub-total	0.63	0.89					

Table 22 . (cont 'd) .

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I. V.	Rank
<b>ANNUAL AND BIENNIAL FORBS</b>							
<i>Lactuca serriola</i>	0.31	0.43	0 - 4	7.69	1.37	1.80	11
<i>Sisymbrium altissimum</i>	0.15	0.22	0 - 2	7.69	1.37	1.59	12
Sub-total	0.46	0.65					
<b>SEMI-SHRUBS OR HALF-SHRUBS</b>							
<i>Artemisia frigida</i>	0.31	0.43	0 - 0	7.69	1.37	1.80	11
Sub-total	0.31	0.43					
<b>SHRUBS</b>							
<i>Artemisia filifolia</i>	28.00	39.52	6 - 54	92.31	16.44	55.95	1
<i>Eriogonum effusum</i>	0.77	1.09	0 - 6	15.38	2.74	3.83	8
Sub-total	28.77	40.60					
SUM OF SPECIES COVER	70.86						
LITTER	28.15		6 - 64	100.00			
TOTAL VEGETATION	71.00 +/-	21.10					
LITTER/ROCK	28.15 +/-	20.37					
BARE SOIL	0.85 +/-	1.72					
TOTAL COVER	99.15 +/-	1.72					
Number of Species/sample	4.77						

Table 23. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE SAND SAGEBRUSH SHRUBLAND TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
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COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS

<i>Stipa comata</i>	41	10	3
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INTRODUCED PERENNIAL GRASSES

<i>Agropyron desertorum</i>	49		1
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ANNUAL GRASSES

<i>Bromus tectorum</i>	30	6	5
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SHRUBS

<i>Artemisia filifolia</i>	66	11	12
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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 12)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
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<i>Artemisia filifolia</i>	6250	3214
<i>Eriogonum effusum</i>	608	900
<i>Opuntia compressa</i>	150	254
<i>Opuntia polyacantha</i>	8	12

TOTAL	7016	3618
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ole 24 .

LIST OF SPECIES OBSERVED IN THE SAND SAGEBRUSH SHRUBLAND  
TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS  
MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron riparium</i>	Streambank Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Carex filifolia</i>	Threadleaf Sedge	Cyperaceae
<i>Carex heliophila</i>	Sun Sedge	Cyperaceae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Andropogon hallii</i>	Sandhills Bluestem	Gramineae
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Calamovilfa longifolia</i>	Prairie Sandreed	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Aster ericoides</i>	Heath Aster	Compositae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Delphinium virescens</i>	Larkspur	Ranunculaceae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Liatris punctata</i>	Gay Feather	Compositae
<i>Lupinus argenteus</i>	Silvery Lupine	Leguminosae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Physalis hederifolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Thelesperma megapotamicum</i>	Thelesperma	Compositae

Table 24.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Tradescantia occidentalis</i>	Spiderwort	Commelinaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
ANNUAL AND BIENNIAL FORBS		
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Cleome serrulata</i>	Rocky Mt. Bee Plant	Capparidaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Froelichia gracilis</i>	Froelichia	Amaranthaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Oenothera albicaulis</i>	Prairie Evening Primrose	Onagraceae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Salsola collina</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia ludoviciana</i>	Louisiana Sagewort	Compositae
SHRUBS		
<i>Artemisia filifolia</i>	Sand Sage	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
<i>Opuntia compressa</i>	Prickly Pear Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae

Table 25.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
RUBBER RABBITBUSH SHRUBLAND TYPE ON THE ROCKY MOUNTAIN  
ARSENAL.. BASED ON DATA FROM 10 SAMPLING SITES. 1986 DATA.  
+/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
Agropyron smithii	0.20	0.27	0 - 2	10.00	1.59	1.86	13
Aristida longisetia	7.40	10.05	0 - 26	60.00	9.52	19.58	4
Stipa comata	2.20	2.99	0 - 14	40.00	6.35	9.34	7
Sub-total	9.80	13.32					
<b>WARM SEASON PERENNIAL GRASSES</b>							
Sporobolus cryptandrus	13.20	17.93	0 - 32	80.00	12.70	30.63	3
Sub-total	13.20	17.93					
<b>ANNUAL GRASSES</b>							
Bromus tectorum	16.20	22.01	0 - 34	90.00	14.29	36.30	2
Sub-total	16.20	22.01					
<b>PERENNIAL FORBS</b>							
Ambrosia psillostachya	0.60	0.82	0 - 4	20.00	3.17	3.99	9
Antennaria rosea	0.20	0.27	0 - 2	10.00	1.59	1.86	13
Aster falcatus	2.20	2.99	0 - 10	40.00	6.35	9.34	7
Convolvulus arvensis	0.40	0.54	0 - 2	20.00	3.17	3.72	10
Evolvulus nuttallianus	0.20	0.27	0 - 2	10.00	1.59	1.86	13
Heterotheca villosa	2.40	3.26	0 - 18	40.00	6.35	9.61	6
Kuhnia eupatorioides	0.20	0.27	0 - 2	10.00	1.59	1.86	13
Oenothera coronopifolia	0.20	0.27	0 - 2	10.00	1.59	1.86	13
Senecio spartioides	0.40	0.54	0 - 4	10.00	1.59	2.13	12
Sphaeralcea coccinea	1.00	1.36	0 - 6	20.00	3.17	4.53	8
Verbascum thapsus	0.20	0.27	0 - 2	10.00	1.59	1.86	13
Sub-total	8.00	10.87					

Table 25. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I. V.	Rank
ANNUAL AND BIENNIAL FORBS							
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	6.40	8.70	0 - 36	30.00	4.76	13.46	5
<i>Descurainia richardsonii</i>	1.40	1.90	0 - 14	10.00	1.59	3.49	11
<i>Lactuca serriola</i>	0.20	0.27	0 - 2	10.00	1.59	1.86	13
Sub-total	8.00	10.87					
SHRUBS							
<i>Chrysothamnus nauseosus</i>	18.40	25.00	8 - 46	100.00	15.87	40.87	1
Sub-total	18.40	25.00					
SUM OF SPECIES COVER	73.60						
LITTER	26.00		14 - 50	100.00			
TOTAL VEGETATION	73.60 +/-	11.69					
LITTER/ROCK	26.00 +/-	10.67					
BARE SOIL	0.40 +/-	1.26					
TOTAL COVER	99.60 +/-	1.26					
Number of Species/sample	6.30						



Table 26. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE RUBBER RABBITBRUSH SHRUBLAND TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
WARM SEASON PERENNIAL GRASSES			
<i>Sporobolus cryptandrus</i>	46	2	2
ANNUAL GRASSES			
<i>Bromus tectorum</i>	44		1
SHRUBS			
<i>Chrysothamnus nauseosus</i>	117	17	10

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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
<i>Chrysothamnus nauseosus</i>	2160	1737
<i>Opuntia compressa</i>	110	185
<i>Yucca glauca</i>	130	275
TOTAL	2550	1914

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Table 27.

LIST OF SPECIES OBSERVED IN THE RUBBER RABBITBRUSH  
SHRUBLAND TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON  
OBSERVATIONS MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Carex</i> sp.	Sedge	Cyperaceae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Antennaria rosea</i>	Pussytoes	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Euphorbia marginata</i>	Snow-on-the-mountain	Euphorbiaceae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Ipomoea leptophylla</i>	Bush Morning Glory	Convolvulaceae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Lupinus argenteus</i>	Silvery Lupine	Leguminosae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Physalis hederifolia</i>	Ground Cherry	Solanaceae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae

Table 27. (cont'd.)

Scientific Name	Common Name	Family Name
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Descurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Salsola collina</i>	Russian-thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<b>SEMI-SHRUBS OR HALF-SHRUBS</b>		
<i>Artemisia dracunculus</i>	Green Sage	Compositae
<b>SHRUBS</b>		
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Prunus americana</i>	Wild Plum	Rosaceae
<i>Ribes aureum</i>	Golden Currant	Grossulariaceae
<b>CACTI AND SUCCULENTS</b>		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae

Table 28.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
SEMI-SHRUB AND SUCCULENT (YUCCA) TYPE ON THE ROCKY MOUNTAIN  
ARSENAL. BASED ON DATA FROM 10 SAMPLING LOCATIONS. 1986  
DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
<i>Aristida longiseta</i>	8.80	12.83	0 - 28	80.00	12.90	25.73	4
<i>Stipa comata</i>	10.40	15.16	0 - 32	70.00	11.29	26.45	3
Sub-total	19.20	27.99					
WARM SEASON PERENNIAL GRASSES							
<i>Bouteloua gracilis</i>	3.00	4.37	0 - 16	30.00	4.84	9.21	6
<i>Sporobolus cryptandrus</i>	9.00	13.12	0 - 36	70.00	11.29	24.41	5
Sub-total	12.00	17.49					
ANNUAL GRASSES							
<i>Bromus tectorum</i>	9.40	13.70	0 - 34	90.00	14.52	28.22	2
Sub-total	9.40	13.70					
PERENNIAL FORBS							
<i>Ambrosia psilostachya</i>	1.40	2.04	0 - 8	30.00	4.84	6.88	8
<i>Evolvulus nuttallianus</i>	1.40	2.04	0 - 6	40.00	6.45	8.49	7
<i>Heterotheca villosa</i>	0.40	0.58	0 - 2	20.00	3.23	3.81	11
<i>Lithospermum incisum</i>	0.20	0.29	0 - 2	10.00	1.61	1.90	13
<i>Lupinus argenteus</i>	0.60	0.87	0 - 4	20.00	3.23	4.10	10
<i>Lygodesmia juncea</i>	0.20	0.29	0 - 2	10.00	1.61	1.90	13
<i>Psoralea tenuiflora</i>	0.60	0.87	0 - 2	30.00	4.84	5.71	9
<i>Sphaeralcea coccinea</i>	0.20	0.29	0 - 2	10.00	1.61	1.90	13
Sub-total	5.00	7.29					
SHRUBS							
<i>Eriogonum effusum</i>	0.80	1.17	0 - 8	10.00	1.61	2.78	12
Sub-total	0.80	1.17					

Table 28. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I. V.	Rank
CACTI AND SUCCULENTS							
Yucca glauca	22.20	32.36	6 - 40	100.00	16.13	48.49	1
Sub-total	22.20	32.36					
SUM OF SPECIES COVER							
	68.60						
LITTER	27.60		8 - 44	100.00			
TOTAL VEGETATION							
	68.60 +/-	8.28					
LITTER/ROCK	27.60 +/-	9.51					
BARE SOIL	3.80 +/-	3.94					
TOTAL COVER	96.20 +/-	3.94					
Number of Species/sample	6.20						

Table 29. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE SEMI-SHRUB AND SUCCULENT (YUCCA) TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
Aristida longiseta	20		1
Stipa comata	36	4	4
WARM SEASON PERENNIAL GRASSES			
Sporobolus cryptandrus	38	3	2
ANNUAL GRASSES			
Bromus tectorum	20		1
CACTI AND SUCCULENTS			
Yucca glauca	57	5	10

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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
Eriogonum effusum	410	1297
Opuntia compressa	450	440
Opuntia polyacantha	190	601
Yucca glauca	8630	4767
TOTAL	9680	4577

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LIST OF SPECIES OBSERVED GROWING IN THE  
SEMI-SHRUB/SUCCULENT (YUCCA) TYPE AT THE ROCKY MOUNTAIN  
ARSENAL. BASED ON OBSERVATIONS MADE DURING THE 1986 GROWING  
SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Carex filifolia</i>	Threadleaf Sedge	Cyperaceae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Abronia fragrans</i>	Sand Verbena	Nyctaginaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Lithospermum incisum</i>	Narrowleaf Gromwell	Boraginaceae
<i>Lupinus argenteus</i>	Silvery Lupine	Leguminosae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Petalostemon compactus</i>	Compact Prairie Clover	Leguminosae
<i>Physalis hederifolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae

Scientific Name	Common Name	Family Name
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Croton texensis</i>	Croton	Euphorbiaceae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia dracunculus</i>	Green Sage	Compositae
SHRUBS		
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
<i>Coryphantha vivipara</i>	Ball Cactus	Cactaceae
<i>Opuntia compressa</i>	Prickly Pear Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae



Table 31.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
LOCUST THICKET TYPE ON THE ROCKY MOUNTAIN ARSENAL. BASED ON  
DATA FROM 10 SAMPLING LOCATIONS. 1986 DATA. +/- VALUES  
EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron trachycaulum	0.60	0.68	0 - 6	10.00	4.00	4.68	6
Sub-total	0.60	0.68					
INTRODUCED PERENNIAL GRASSES							
Agropyron desertorum	0.60	0.68	0 - 6	10.00	4.00	4.68	6
Sub-total	0.60	0.68					
ANNUAL GRASSES							
Bromus tectorum	72.00	81.82	0 - 98	90.00	36.00	117.82	1
Sub-total	72.00	81.82					
PERENNIAL FORBS							
Cirsium arvense	1.00	1.14	0 - 10	10.00	4.00	5.14	5
Nepeta cataria	0.40	0.45	0 - 4	10.00	4.00	4.45	7
Sub-total	1.40	1.59					
ANNUAL AND BIENNIAL FORBS							
Kochia iranica	1.80	2.05	0 - 16	20.00	8.00	10.05	3
Sisymbrium altissimum	2.00	2.27	0 - 20	10.00	4.00	6.27	4
Sub-total	3.80	4.32					
TREES							
Robinia neomexicana	9.60	10.91	0 - 32	90.00	36.00	46.91	2
Sub-total	9.60	10.91					
SUM OF SPECIES COVER							
	88.00						
LITTER							
	12.00		2 - 48	100.00			

Table 31.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
TOTAL VEGETATION	88.00 +/-	17.99					
LITTER/ROCK	12.00 +/-	17.99					
TOTAL COVER	100.00 +/-	0.00					
Number of Species/sample	2.50						

Table 32. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE LOCUST THICKET TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
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NO HEIGHT DATA RECORDED IN THIS TYPE

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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
Opuntia compressa	10	32
Robinia neomexicana	5720	3536
Ulmus pumila	10	32
TOTAL	5740	3517

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LIST OF SPECIES OBSERVED GROWING IN THE LOCUST THICKET TYPE  
AT THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS MADE  
DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Muhlenbergia racemosa</i>	Marsh Muhly	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>PRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Agropyron elongatum</i>	Tall Wheatgrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Nepeta cataria</i>	Catnip	Labiatae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Carduus nutans ssp. macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae
<b>SHRUBS</b>		
<i>Lycium halimifolium</i>	Matrimony Bush	Solanaceae
<i>Syringa vulgaris</i>	Lilac	Oleaceae
<b>ACTINOPHYTES AND SUCCULENTS</b>		
<i>Opuntia compressa</i>	Prickly Pear Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae
<b>TREES</b>		
<i>Acer negundo</i>	Box-elder	Aceraceae

e 33.(cont'd.)

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Scientific Name

Common Name

Family Name

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Elaeagnus angustifolia

Russian Olive

Elaeagnaceae

Populus sargentii

Plains Cottonwood

Salicaceae

Robinia neomexicana

New Mexico Black Locust

Leguminosae

Ulmus pumila

Chinese Elm

Ulmaceae

Table 34.

COVER: FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
COTTONWOOD-WILLOW TYPE ON THE ROCKY MOUNTAIN ARSENAL.  
BASED ON DATA FROM 10 SAMPLING LOCATIONS. 1986 DATA. +/-  
VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron smithii	1.40	2.12	0 - 6	40.00	8.33	10.45	6
Agropyron trachycaulum	8.60	13.03	0 - 34	60.00	12.50	25.53	3
Elymus canadensis	4.80	7.27	0 - 14	70.00	14.58	21.86	4
Muhlenbergia asperifolia	0.40	0.61	0 - 4	10.00	2.08	2.69	13
Stipa comata	0.20	0.30	0 - 2	10.00	2.08	2.39	14
Sub-total	15.40	23.33					
WARM SEASON PERENNIAL GRASSES							
Sporobolus cryptandrus	0.20	0.30	0 - 2	10.00	2.08	2.39	14
Sub-total	0.20	0.30					
INTRODUCED PERENNIAL GRASSES							
Agropyron desertorum	1.40	2.12	0 - 8	30.00	6.25	8.37	9
Bromopsis inermis	22.60	34.24	0 - 70	50.00	10.42	44.66	1
Poa pratensis	4.20	6.36	0 - 40	20.00	4.17	10.53	5
Sub-total	28.20	42.73					
ANNUAL GRASSES							
Bromus japonicus	2.20	3.33	0 - 14	30.00	6.25	9.58	8
Bromus tectorum	14.40	21.82	0 - 52	60.00	12.50	34.32	2
Sub-total	16.60	25.15					
PERENNIAL FORBS							
Ambrosia psilostachya	0.80	1.21	0 - 8	10.00	2.08	3.30	12
Cardaria draba	1.20	1.82	0 - 12	10.00	2.08	3.90	11
Cirsium arvense	2.60	3.94	0 - 18	30.00	6.25	10.19	7
Senecio spartioides	0.40	0.61	0 - 4	10.00	2.08	2.69	13
Sub-total	5.00	7.58					

Table 34. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
ANNUAL AND BIENNIAL FORBS							
Lactuca serriola	0.40	0.61	0 - 2	20.00	4.17	4.77	10
Sub-total	0.40	0.61					
TREES							
Populus sargentii	0.20	0.30	0 - 2	10.00	2.08	2.39	14
Sub-total	0.20	0.30					
SUM OF SPECIES COVER	66.00						
LITTER	33.40		18 - 44	100.00			
TOTAL VEGETATION	66.40 +/-	7.17					
LITTER/ROCK	33.40 +/-	7.06					
BARE SOIL	0.20 +/-	0.63					
TOTAL COVER	99.80 +/-	0.63					
Number of Species/sample	4.80						

Table 35. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE COTTONWOOD-WILLOW TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

HEIGHTS OF MAJOR SPECIES			
SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
<i>Elymus canadensis</i>	93	8	9
ANNUAL GRASSES			
<i>Bromus tectorum</i>	61	32	2
PERENNIAL FORBS			
<i>Cirsium arvense</i>	81		1
DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)			
SPECIES	NUMBER/HECTARE	STANDARD DEVIATION	
<i>Juniperus scopulorum</i>	50	108	
<i>Populus sargentii</i>	640	280	
<i>Salix amygdaloides</i>	120	380	
TOTAL	810	435	



Table 36.

LIST OF SPECIES OBSERVED IN THE COTTONWOOD-WILLOW  
TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS  
MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Calamovilfa longifolia</i>	Prairie Sandreed	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Agropyron elongatum</i>	Tall Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Asclepias viridiflora</i>	Green Milkweed	Asclepiadaceae
<i>Asparagus officinalis</i>	Asparagus	Asparagaceae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Euthamia occidentalis</i>	Western Goldenrod	Compositae
<i>Glycyrrhiza lepidota</i>	Wild Licorice	Leguminosae
<i>Hippochaete laevigata</i>	Scouring Rush	Equisetaceae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae

Table 36.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia ludoviciana</i>	Louisiana Sagewort	Compositae
SHRUBS		
<i>Salix exigua</i>	Coyote Willow	Salicaceae
TREES		
<i>Elaeagnus angustifolia</i>	Russian Olive	Elaeagnaceae
<i>Juniperus scopulorum</i>	Rocky Mtn. Juniper	Cupressaceae
<i>Populus sargentii</i>	Plains Cottonwood	Salicaceae
<i>Salix amygdaloides</i>	Peach-leaved Willow	Salicaceae

Table 37.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
BOTTOMLAND MEADOW TYPE ON THE ROCKY MOUNTAIN ARSENAL. BASED  
ON DATA FROM 11 SAMPLING LOCATIONS. 1986 DATA. +/- VALUES  
EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron smithii	2.45	2.86	0 - 16	18.18	2.27	5.14	15
Agropyron trachycaulum	3.00	3.50	0 - 18	36.36	4.55	8.04	9
Carex praegracilis	1.64	1.91	0 - 12	27.27	3.41	5.32	14
Distichlis stricta	2.18	2.55	0 - 16	18.18	2.27	4.82	16
Elymus canadensis	0.55	0.64	0 - 6	9.09	1.14	1.77	23
Juncus sp.	1.82	2.12	0 - 18	18.18	2.27	4.39	17
Muhlenbergia asperifolia	1.45	1.70	0 - 16	9.09	1.14	2.83	21
Scirpus americanus	4.18	4.88	0 - 24	36.36	4.55	9.42	6
Sub-total	17.27	20.15					
INTRODUCED PERENNIAL GRASSES							
Poa pratensis	3.45	4.03	0 - 26	18.18	2.27	6.30	13
Sub-total	3.45	4.03					
ANNUAL GRASSES							
Bromus japonicus	0.09	0.11	0 - 0	9.09	1.14	1.24	26
Bromus tectorum	0.55	0.64	0 - 6	9.09	1.14	1.77	23
Echinochloa crus-galli	5.27	6.15	0 - 28	27.27	3.41	9.56	5
Panicum capillare	4.73	5.51	0 - 46	18.18	2.27	7.79	11
Polypogon monspeliensis	2.91	3.39	0 - 16	36.36	4.55	7.94	10
Sub-total	13.55	15.80					
PERENNIAL FORBS							
Ambrosia psilostachya	0.36	0.42	0 - 4	9.09	1.14	1.56	24
Asclepias speciosa	2.82	3.29	0 - 10	45.45	5.68	8.97	7
Aster ericoides	0.36	0.42	0 - 2	18.18	2.27	2.70	22
Cardaria draba	0.18	0.21	0 - 2	9.09	1.14	1.35	25

Table 37. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Cirsium arvense</i>	19.27	22.48	0 - 54	72.73	9.09	31.57	1
<i>Convolvulus arvensis</i>	0.18	0.21	0 - 0	9.09	1.14	1.35	25
<i>Euthamia occidentalis</i>	1.82	2.12	0 - 20	9.09	1.14	3.26	19
<i>Persicaria maculata</i>	4.73	5.51	0 - 30	36.36	4.55	10.06	4
<i>Rumex crispus</i>	0.18	0.21	0 - 2	9.09	1.14	1.35	25
<i>Solidago canadensis</i>	3.82	4.45	0 - 28	18.18	2.27	6.73	12
<i>Verbascum thapsus</i>	0.55	0.64	0 - 2	27.27	3.41	4.05	18
Sub-total	34.27	39.98					
ANNUAL AND BIENNIAL FORBS							
<i>Carduus nutans</i> ssp. <i>macrocephalus</i>	0.55	0.64	0 - 0	9.09	1.14	1.77	23
<i>Chenopodium album</i>	0.36	0.42	0 - 4	9.09	1.14	1.56	24
<i>Chenopodium leptophyllum</i>	0.55	0.64	0 - 6	9.09	1.14	1.77	23
<i>Conyza canadensis</i>	4.36	5.09	0 - 20	45.45	5.68	10.77	3
<i>Gaura parviflora</i>	0.55	0.64	0 - 4	18.18	2.27	2.91	20
<i>Iva xanthifolia</i>	0.18	0.21	0 - 2	9.09	1.14	1.35	25
<i>Lactuca scariola</i>	3.36	3.92	0 - 14	63.64	7.95	11.88	2
<i>Melilotus alba</i>	5.45	6.36	0 - 54	18.18	2.27	8.64	8
<i>Melilotus officinalis</i>	0.55	0.64	0 - 4	18.18	2.27	2.91	20
<i>Polygonum ramocissum</i>	0.18	0.21	0 - 2	9.09	1.14	1.35	25
<i>Salsola collina</i>	0.18	0.21	0 - 2	9.09	1.14	1.35	25
<i>Salsola iberica</i>	0.55	0.64	0 - 6	9.09	1.14	1.77	23
<i>Sonchus asper</i>	0.36	0.42	0 - 2	18.18	2.27	2.70	22
Sub-total	17.18	20.04					
SUM OF SPECIES COVER	85.73						
LITTER	10.82		0 - 59	81.82			
TOTAL VEGETATION	89.10 +/-	17.35					

Table 37 .(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
LITTER/ROCK	10.82 +/-	17.35					
TOTAL COVER	100.00 +/-	0.00					
Number of Species/sample	8.00						

Table 38. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE BOTTOMLAND MEADOW TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
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COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS

Agropyron smithii	64		1
Hordeum jubatum	62		1

ANNUAL GRASSES

Panicum capillare	72		1
Polypogon monspeliensis	43		1

PERENNIAL FORBS

Asclepias speciosa	76	7	3
Cirsium arvense	103	6	3

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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
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NO SHRUBS ENCOUNTERED ALONG SAMPLE TRANSECTS

Table 39.

LIST OF SPECIES OBSERVED GROWING IN THE BOTTOMLAND MEADOW  
TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS  
MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Carex</i> sp.	Sedge	Cyperaceae
<i>Distichlis stricta</i>	Inland Saltgrass	Gramineae
<i>Eleocharis macrostachya</i>	Common Spikerush	Cyperaceae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Juncus</i> sp.	Juncus	Juncaceae
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Oryzopsis hymenoides</i>	Indian Ricegrass	Gramineae
<i>Phalaris arundinacea</i>	Reed Canarygrass	Gramineae
<i>Sciurus americanus</i>	Chairmaker's Rush	Cyperaceae
<i>Sciurus lacustris</i> ssp. <i>validus</i>	Tule	Cyperaceae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron elongatum</i>	Tall Wheatgrass	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Beckmannia syzigachne</i>	Sloughgrass	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Echinochloa crus-galli</i>	Barneyard Grass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Polypogon monspeliensis</i>	Rabbitfoot Grass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Anaphalis margaritacea</i>	Pearly Everlasting	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Asclepias viridiflora</i>	Green Milkweed	Asclepiadaceae
<i>Aster ericoides</i>	Heath Aster	Compositae
<i>Aster</i> sp.	Aster	Compositae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Cardaria draba</i>	White Weed	Cruciferae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Euthamia occidentalis</i>	Western Goldenrod	Compositae
<i>Medicago sativa</i>	Alfalfa	Leguminosae
<i>Persicaria maculata</i>	Lady's Thumb	Polygonaceae
<i>Potentilla norvegica</i>	Cinquefoil	Rosaceae
<i>Rumex crispus</i>	Curly Dock	Polygonaceae
<i>Solidago canadensis</i>	Canada Goldenrod	Compositae
<i>Solidago rigida</i>	Stiff Goldenrod	Compositae

Table 39.(cont'd.)

Scientific Name	Common Name	Family Name
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<i>Veronica anagallis-aquatica</i>	Water Speedwell	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus arenicola</i>	Sand Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Bidens frondosa</i>	Beggars Ticks	Compositae
<i>Cirsium nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Eriogonum atriplicifolium</i>	Winged Pigweed	Chenopodiaceae
<i>Illoium paniculatum</i>	Willow Herb	Onagraceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Iva xanthifolia</i>	Marsh Elder	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Oenothera strigosa</i>	Evening Primrose	Onagraceae
<i>Polygonum ramocissiumum</i>	Branched Knotweed	Polygonaceae
<i>Salsola collina</i>	Russian-thistle	Chenopodiaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Sonchus asper</i>	Annual Sow-thistle	Compositae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<b>SHRUBS</b>		
<i>Salix exigua</i>	Coyote Willow	Salicaceae
<b>TREES</b>		
<i>Elaeagnus angustifolia</i>	Russian Olive	Elaeagnaceae
<i>Populus sargentii</i>	Plains Cottonwood	Salicaceae
<i>Salix amygdaloides</i>	Peach-leaved Willow	Salicaceae



Table 40.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CATTAIL MARSH TYPE AT THE ROCKY MOUNTAIN ARSENAL. BASED ON  
DATA FROM 10 SAMPLING LOCATIONS. 1986 DATA. +/- VALUES  
EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
<i>Scirpus americanus</i>	0.40	0.45	0 - 4	10.00	4.55	4.99	7
Sub-total	0.40	0.45					
PERENNIAL FORBS							
<i>Asclepias incarnata</i>	2.20	2.45	0 - 22	10.00	4.55	7.00	5
<i>Cirsium arvense</i>	3.00	3.34	0 - 10	50.00	22.73	26.07	3
<i>Mentha arvensis</i>	0.20	0.22	0 - 2	10.00	4.55	4.77	8
<i>Typha angustifolia</i>	32.00	35.63	0 - 94	40.00	18.18	53.82	2
<i>Typha latifolia</i>	49.80	55.46	0 - 92	60.00	27.27	82.73	1
Sub-total	87.20	97.10					
ANNUAL AND BIENNIAL FORBS							
<i>Conyza canadensis</i>	0.60	0.67	0 - 6	10.00	4.55	5.21	6
<i>Epilobium paniculatum</i>	1.00	1.11	0 - 6	20.00	9.09	10.20	4
<i>Lactuca serriola</i>	0.60	0.67	0 - 6	10.00	4.55	5.21	6
Sub-total	2.20	2.45					
SUM OF SPECIES COVER	89.80						
LITTER	10.20		2 - 32	100.00			
TOTAL VEGETATION	89.80 +/-	8.72					
LITTER/ROCK	10.20 +/-	8.72					
TOTAL COVER	100.00 +/-	0.00					
Number of Species/sample	2.20						

Table 4. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE CATTAIL MARSH TYPE AT THE ROCKY MOUNTAIN ARSENAL. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
<hr/>			
PERENNIAL FORBS			
Typha angustifolia	176		1
Typha latifolia	174	43	9

DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
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NO SHRUBS ENCOUNTERED ALONG SAMPLE TRANSECTS

Table 42

LIST OF SPECIES OBSERVED GROWING IN THE CATTAIL MARSH TYPE  
AT THE ROCKY MOUNTAIN ARSENAL. BASED ON OBSERVATIONS MADE  
DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Distichlis stricta</i>	Inland Saltgrass	Gramineae
<i>Hordeum jubatum</i>	Foxtail Barley	Gramineae
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Phalaris arundinacea</i>	Reed Canarygrass	Gramineae
<i>Scirpus americanus</i>	Chairmaker's Rush	Cyperaceae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Echinochloa crus-galli</i>	Barnyard Grass	Gramineae
<i>Polypogon monspeliensis</i>	Rabbitfoot Grass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias incarnata</i>	Swamp Milkweed	Asclepiadaceae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Euthamia occidentalis</i>	Western Goldenrod	Compositae
<i>Mentha arvensis</i>	Field Mint	Labiatae
<i>Persicaria maculata</i>	Lady's Thumb	Polygonaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Potentilla norvegica</i>	Cinquefoil	Rosaceae
<i>Rumex crispus</i>	Curly Dock	Polygonaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Teucrium canadense</i>	Germander	Labiatae
<i>Typha angustifolia</i>	Narrow-leaved Cattail	Typhaceae
<i>Typha latifolia</i>	Common Cattail	Typhaceae
<i>Urtica dioica</i> ssp. <i>gracilis</i>	Stinging Nettle	Urticaceae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<b>ANNUAL AND BIENNIAL FORBS</b>		
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Bidens frondosa</i>	Beggars Ticks	Compositae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Epilobium paniculatum</i>	Willow Herb	Onagraceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Polygonum ramocissimum</i>	Branched Knotweed	Polygonaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Salvia reflexa</i>	Salvia	Labiatae
<b>SHRUBS</b>		
<i>Salix exigua</i>	Coyote Willow	Salicaceae

Table 42.(cont'd.)

Scientific Name	Common Name	Family Name
TREES		
Populus sargentii	Plains Cottonwood	Salicaceae
Salix amygdaloides	Peach-leaved Willow	Salicaceae

Table 43.

COVER, FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE MIXED GRASS PRAIRIE TYPE AT BUCKLEY FIELD. BASED ON DATA FROM 51 SAMPLING LOCATIONS. 1986 DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron smithii	16.24	34.54	0 - 42	96.08	11.58	45.13	1
Aristida longisetata	4.45	9.47	0 - 18	78.43	9.46	18.93	3
Poa sandbergii	0.02	0.04	0 - 1	1.96	0.24	0.28	38
Stipa comata	2.45	5.21	0 - 31	21.57	2.60	7.82	7
Stipa viridula	0.02	0.04	0 - 1	1.96	0.24	0.28	38
Sub-total	23.18	49.31					
WARM SEASON PERENNIAL GRASSES							
Bouteloua gracilis	3.49	7.43	0 - 36	43.14	5.20	12.63	4
Buchloe dactyloides	3.43	7.30	0 - 59	37.25	4.49	11.79	5
Sporobolus cryptandrus	0.33	0.71	0 - 5	11.76	1.42	2.13	20
Sub-total	7.25	15.44					
INTRODUCED PERENNIAL GRASSES							
Agropyron desertorum	0.35	0.75	0 - 7	9.80	1.18	1.93	24
Poa pratensis	0.02	0.04	0 - 1	1.96	0.24	0.28	38
Sub-total	0.37	0.79					
ANNUAL GRASSES							
Bromus japonicus	1.47	3.13	0 - 21	23.53	2.84	5.97	9
Bromus tectorum	5.45	11.60	0 - 31	78.43	9.46	21.05	2
Sub-total	6.92	14.73					
PERENNIAL FORBS							
Ambrosia psilostachya	0.39	0.83	0 - 8	9.80	1.18	2.02	23
Asclepias uncialis	0.02	0.04	0 - 1	1.96	0.24	0.28	38
Aster falcatus	0.37	0.79	0 - 7	13.73	1.65	2.15	18

Table 43 (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Astragalus drummondii</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Cirsium undulatum</i>	0.04	0.08	0 -	2	1.96	0.24	37
<i>Convolvulus arvensis</i>	0.08	0.17	0 -	4	1.96	0.24	35
<i>Erysimum asperum</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Evolvulus nuttallianus</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Gaura coccinea</i>	0.04	0.08	0 -	1	3.92	0.47	34
<i>Heterotheca villosa</i>	0.47	1.00	0 -	6	21.57	2.60	12
<i>Kuhnia eupatorioides</i>	0.11	0.88	0 -	6	13.73	1.65	17
<i>Lygodesmia juncea</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Machaeranthera plumatifida</i>	0.08	0.17	0 -	2	7.84	0.95	29
<i>Oenothera coronopifolia</i>	0.20	0.42	0 -	3	13.73	1.65	22
<i>Picradenopsis oppositifolia</i>	0.18	0.38	0 -	3	9.80	1.18	26
<i>Psoralea tenuiflora</i>	0.78	1.67	0 -	9	27.45	3.31	10
<i>Senecio spartioides</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Senecio tridenticulatus</i>	0.25	0.54	0 -	3	13.73	1.65	19
<i>Solidago missouriensis</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Solidago rigida</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Sphaeralcea coccinea</i>	1.43	3.05	0 -	6	50.98	6.15	6
<i>Stephanomeria pauciflora</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Thelesperma megapotamicum</i>	0.10	0.21	0 -	3	3.92	0.47	33
<i>Verbascum thapsus</i>	0.22	0.46	0 -	3	13.73	1.65	21
Sub-total	5.22	11.10					
ANNUAL AND BIENNIAL FORBS							
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	0.04	0.08	0 -	2	1.96	0.24	37
<i>Cirsium canescens</i>	0.02	0.04	0 -	1	1.96	0.24	38
<i>Conyza canadensis</i>	0.16	0.33	0 -	3	9.80	1.18	27
<i>Erigeron divergens</i>	0.25	0.54	0 -	3	17.65	2.13	15
<i>Hedeoma hispidum</i>	0.31	0.67	0 -	4	15.69	1.89	16

Table 13 (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Lactuca serriola</i>	0.08	0.17	0 - 2	5.88	9.71	0.88	31
<i>Nachaeranthra canescens</i>	0.22	0.46	0 - 3	9.80	1.18	1.64	25
<i>Melilotus officinalis</i>	0.08	0.17	0 - 1	7.84	0.95	1.11	29
<i>Plantago patagonica</i>	0.06	0.13	0 - 1	5.88	0.71	0.83	32
<i>Solanum triflorum</i>	0.06	0.13	0 - 3	1.96	0.24	3.56	36
Sub-total	1.27	2.71					
SEMI SHRUBS OR HALF-SHRUBS							
<i>Artemisia frigida</i>	1.22	2.59	0 - 10	33.33	4.02	6.61	8
<i>Artemisia ludoviciana</i>	0.12	0.25	0 - 3	5.88	0.71	0.96	33
<i>Gutierrezia sarothrae</i>	0.33	0.71	0 - 3	21.57	2.60	3.31	13
Sub-total	1.67	3.55					
SHRUBS							
<i>Ceratoides lanata</i>	0.04	0.08	0 - 1	1.96	0.24	0.32	37
<i>Chrysothamnus nauseosus</i>	0.55	1.17	0 - 5	25.49	3.07	4.24	11
<i>Eriogonum effusum</i>	0.06	0.13	0 - 1	5.88	0.71	0.83	32
Sub-total	0.65	1.38					
CACTI AND SUCCULENTS							
<i>Opuntia polyacantha</i>	0.33	0.71	0 - 4	17.65	2.13	2.84	14
<i>Yucca glauca</i>	0.14	0.29	0 - 3	7.84	0.95	1.24	28
Sub-total	0.47	1.00					
SUM OF SPECIES COVER	47.00						
TOTAL VEGETATION							
LITTER/ROCK	47.00 +/-	15.45					
	46.73 +/-	14.13					

Table 43 (cont'd)

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
BAKE SOIL	6.27 +/-	6.56					
TOTAL COVER	93.73 +/-	6.56					
Number of Species/sample	8.29						



Table 44. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE MIDGRASS PRAIRIE TYPE AT BUCKLEY FIELD, 1986 DATA.

HEIGHTS OF MAJOR SPECIES			
SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
<i>Agropyron smithii</i>	21	7	40
<i>Aristida longiseta</i>	17	2	7
<i>Stipa comata</i>	28	6	2
ANNUAL GRASSES			
<i>Bromus japonicus</i>	24	1	2
<i>Bromus tectorum</i>	22	5	29
ANNUAL FORBS			
<i>Verbascum thapsus</i>	42	36	2
SEMI-SHRUBS			
<i>Artemisia frigida</i>	21	2	2
SHRUBS			
<i>Chrysothamnus nauseosus</i>	37	27	4
DENSITY OF WOODY SPECIES AND CACTI (Sample size = 51)			
SPECIES	NUMBER/HECTARE	STANDARD DEVIATION	
<i>Ceratoides lanata</i>	31	130	
<i>Chrysothamnus nauseosus</i>	310	652	
<i>Coryphantha vivipara</i>	33	185	
<i>Eriogonum effusum</i>	82	322	
<i>Opuntia polyacantha</i>	1563	2552	
<i>Yucca glauca</i>	120	369	
TOTAL	2139	3187	

Table 45.

PRODUCTION SUMMARY FOR THE MIDGRASS PRAIRIE TYPE  
AT BUCKLEY FIELD. BASED ON 1986 DATA FROM 51  
SAMPLING LOCATIONS. +/- VALUES EQUAL THE STANDARD  
DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	32.30	0.00 - 93.84	41.47
Aristida longiseta	5.46	0.00 - 37.31	7.02
Carex filifolia	0.18	0.00 - 8.82	0.23
Poa sandbergii	0.06	0.00 - 2.52	0.07
Schedonnardus paniculatus	0.01	0.00 - 0.44	0.01
Stipa comata	2.10	0.00 - 62.55	2.70
Stipa viridula	0.05	0.00 - 2.61	0.07
Sub-total	40.15		51.56
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	4.00	0.00 - 68.70	5.13
Buchloe dactyloides	2.58	0.00 - 60.36	3.31
Sporobolus cryptandrus	0.74	0.00 - 14.05	0.95
Sub-total	7.31		9.39
INTRODUCED PERENNIAL GRASSES			
Agropyron desertorum	1.38	0.00 - 52.58	1.77
ANNUAL GRASSES			
Bromus japonicus	5.72	0.00 - 58.59	7.34
Bromus tectorum	7.12	0.00 - 29.97	9.14
Vulpia octoflora	0.08	0.00 - 1.32	0.10
Sub-total	12.92		16.58
PERENNIAL FORBS			
Ambrosia psilostachya	0.00	0.00 - 0.12	0.00
Aster falcatus	0.44	0.00 - 19.85	0.56
Cirsium arvense	0.01	0.00 - 0.43	0.01
Comandra umbellata	0.00	0.00 - 0.21	0.01
Erysimum asperum	0.07	0.00 - 3.32	0.08
Evolvulus nuttallianus	0.08	0.00 - 4.04	0.11
Heterotheca villosa	2.09	0.00 - 70.46	2.69
Kuhnia eupatorioides	0.94	0.00 - 47.14	1.21
Lithospermum incisum	0.15	0.00 - 7.62	0.20
Oenothera coronopifolia	0.21	0.00 - 4.98	0.26
Oxybaphus linearis	0.01	0.00 - 0.45	0.01

Table 45. (cont'd).

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
<i>Penstemon albidus</i>	0.01	0.00 - 0.35	0.01
<i>Picradeniopsis oppositifolia</i>	0.15	0.00 - 7.53	0.19
<i>Psoralea tenuiflora</i>	1.83	0.00 - 20.19	2.35
<i>Senecio tridenticulatus</i>	0.07	0.00 - 1.68	0.09
<i>Solidago missouriensis</i>	0.33	0.00 - 16.90	0.43
<i>Sphaeralcea coccinea</i>	2.07	0.00 - 14.07	2.66
<i>Thelesperma megapotamicum</i>	0.20	0.00 - 10.02	0.25
<i>Tragopogon dubius</i>	0.39	0.00 - 17.42	0.51
<i>Verbascum thapsus</i>	2.15	0.00 - 109.51	2.76
Sub-total	11.21		14.39
ANNUAL AND BIENNIAL FORBS			
<i>Alyssum minus</i>	0.00	0.00 - 0.09	0.00
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	0.79	0.00 - 39.95	1.02
<i>Chamaesyce serpyllifolia</i>	0.01	0.00 - 0.53	0.01
<i>Conyza canadensis</i>	0.38	0.00 - 9.33	0.49
<i>Erigeron divergens</i>	0.88	0.00 - 19.98	1.13
<i>Hedeoma hispidum</i>	0.52	0.00 - 14.23	0.66
<i>Lactuca serriola</i>	0.02	0.00 - 0.46	0.02
<i>Lepidium densiflorum</i>	0.01	0.00 - 0.13	0.01
<i>Machaeranthera canescens</i>	0.07	0.00 - 3.56	0.09
<i>Plantago patagonica</i>	0.05	0.00 - 0.92	0.07
<i>Portulaca oleracea</i>	0.00	0.00 - 0.10	0.00
<i>Sisymbrium altissimum</i>	0.02	0.00 - 0.91	0.02
Sub-total	2.75		3.53
SEMI-SHRUBS OR HALF-SHRUBS			
<i>Artemisia frigida</i>	2.04	0.00 - 47.11	2.62
<i>Gutierrezia sarothrae</i>	0.00	0.00 - 0.07	0.00
Sub-total	2.05		2.63
SHRUBS			
<i>Eriogonum effusum</i>	0.12	0.00 - 6.37	0.16
TOTAL PRODUCTION	77.88	+/- 35.88	

LIST OF SPECIES OBSERVED GROWING IN THE MIDGRASS PRAIRIE  
TYPE AT BUCKLEY FIELD. BASED ON OBSERVATIONS MADE DURING  
THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Aristida fendleriana</i>	Fendler Three-awn	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Carex filifolia</i>	Threadleaf Sedge	Cyperaceae
<i>Koeleria macrantha</i>	Prairie Junegrass	Gramineae
<i>Poa sandbergii</i>	Sandberg Bluegrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<i>Stipa viridula</i>	Green Needle Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua curtipendula</i>	Side Oats Grama	Gramineae
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Muhlenbergia torreyi</i>	Ring Muhly	Gramineae
<i>Schizachyrium scoparium</i>	Little Bluestem	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Allium textile</i>	Prairie Onion	Liliaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Antennaria rosea</i>	Pussytoes	Compositae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Asclepias uncialis</i>	Dwarf Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus bisulcatus</i>	Two-grooved Milkvetch	Leguminosae
<i>Astragalus crassicaulus</i>	Ground Plum	Leguminosae
<i>Astragalus drummondii</i>	Drummond Milkvetch	Leguminosae
<i>Astragalus gracilis</i>	Slender Milkvetch	Leguminosae

Scientific Name	Common Name	Family Name
<i>Astragalus missouriensis</i>	Missouri Milkvetch	Leguminosae
<i>Castilleja integra</i>	Plains Indian Paintbrush	Scrophulariaceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Comandra umbellata</i>	Bastard Toadflax	Santalaceae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Daisy Fleabane	Compositae
<i>Erysimum asperum</i>	Western Wallflower	Cruciferae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Liatris punctata</i>	Gay Feather	Compositae
<i>Lithospermum incisum</i>	Narrowleaf Gromwell	Boraginaceae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Musineon divaricatum</i>	Musineon	Umbelliferae
<i>Nothocalais cuspidata</i>	False Dandelion	Compositae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Orobanche fasciculata</i>	Cancer Root	Orobanchaceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Penstemon albidus</i>	White Beardtongue	Scrophulariaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Picradeniopsis oppositifolia</i>	Plains Bahia	Compositae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Ratibida columnifera</i>	Prairie Coneflower	Compositae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Solidago missouriensis</i>	Missouri Goldenrod	Compositae
<i>Solidago mollis</i>	Soft Goldenrod	Compositae
<i>Solidago rigida</i>	Stiff Goldenrod	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Thelesperma megapotamicum</i>	Thelesperma	Compositae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<i>Vicia americana</i>	American Vetch	Leguminosae
<i>Viola nuttallii</i>	Nuttall Violet	Violaceae

ANNUAL AND BIENNIAL FORBS

<i>Alyssum minus</i>	Alyssum	Cruciferae
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Scientific Name	Common Name	Family Name
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Amaranthus graecizans</i>	Prostrate Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Cryptantha fendleri</i>	Fendler Cryptantha	Boraginaceae
<i>Oescurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>escurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Draba reptans</i>	White Draba	Cruciferae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>aura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Hedeoma hispidum</i>	False Pennyroyal	Labiatae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Lupinus pusillus</i>	Rusty Lupine	Leguminosae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Microsteris gracilis</i>	Microsteris	Polemoniaceae
<i>Oenothera albicaulis</i>	Prairie Evening Primrose	Onagraceae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Thlaspi arvense</i>	Field Pennycress	Cruciferae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia dracunculus</i>	Green Sage	Compositae
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
<i>Artemisia ludoviciana</i>	Louisiana Sagewort	Compositae
<i>Jutierrezia sarothrae</i>	Broom Snakeweed	Compositae
<i>Leptodactylon pungens</i>	Prickly Gilia	Polemoniaceae
SHRUBS		
<i>Ceratoides lanata</i>	Winterfat	Chenopodiaceae

le 46.(cont'd.)

Scientific Name	Common Name	Family Name
Chrysothamnus nauseosus	Rubber Rabbitbrush	Compositae
Eriogonum effusum	Bushy Eriogonum	Polygonaceae
Prunus americana	Wild Plum	Rosaceae
Ribes aureum	Golden Currant	Grossulariaceae
CACTI AND SUCCULENTS		
Coryphantha vivipara	Ball Cactus	Cactaceae
Opuntia polyacantha	Plains Prickly Pear	Cactaceae
Yucca glauca	Spanish Bayonet	Agavaceae

Table 47.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CRESTED WHEATGRASS TYPE AT RUCKLEY FIELD. BASED ON DATA  
FROM 49 SAMPLING LOCATIONS. 1986 DATA. +/- VALUES EQUAL  
THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
Agropyron smithii	6.29	14.02	0 - 36	69.39	12.23	26.25	2
Aristida longisetia	0.82	1.82	0 - 8	28.57	5.04	6.86	8
Schedonnardus paniculatus	0.12	0.27	0 - 2	8.16	1.44	1.71	19
Stipa viridula	0.14	0.32	0 - 3	8.16	1.44	1.76	18
Sub-total	7.37	16.43					
<b>WARM SEASON PERENNIAL GRASSES</b>							
Bouteloua gracilis	0.53	1.18	0 - 11	14.29	2.52	3.70	11
Buchloe dactyloides	4.88	10.88	0 - 36	40.82	7.19	18.07	3
Sporobolus cryptandrus	0.94	2.09	0 - 14	32.65	5.76	7.85	6
Sub-total	6.35	14.16					
<b>INTRODUCED PERENNIAL GRASSES</b>							
Agropyron desertorum	22.04	49.16	0 - 47	97.96	17.27	66.42	1
Agropyron intermedium	0.71	1.59	0 - 17	8.16	1.44	3.03	12
Bromopsis inermis	0.16	0.36	0 - 3	8.16	1.44	1.80	17
Poa pratensis	0.04	0.09	0 - 2	2.04	0.36	0.45	27
Sub-total	22.96	51.21					
<b>ANNUAL GRASSES</b>							
Bromus japonicus	2.04	4.55	0 - 18	38.78	6.83	11.39	4
Bromus tectorum	1.86	4.14	0 - 25	38.78	6.83	10.98	5
Sub-total	3.90	8.69					
<b>PERENNIAL FORBS</b>							
Ambrosia psilostachya	0.02	0.05	0 - 1	2.04	0.36	0.41	28
Aster falcatus	0.12	0.27	0 - 4	6.12	1.08	1.35	20



Table 7. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I. V.	Rank
<i>Cirsium undulatum</i>	0.02	0.05	0 - 1	2.04	0.36	0.41	28
<i>Convolvulus arvensis</i>	0.10	0.23	0 - 3	4.08	0.72	0.95	23
<i>Gaura coccinea</i>	0.04	0.09	0 - 2	2.04	0.36	0.45	27
<i>Heterotheca villosa</i>	0.06	0.14	0 - 1	6.12	1.08	1.22	22
<i>Iva axillaris</i>	0.02	0.05	0 - 1	2.04	0.36	0.41	28
<i>Kuhnia eupatorioides</i>	0.02	0.05	0 - 1	2.04	0.36	0.41	28
<i>Lygodesmia juncea</i>	0.04	0.09	0 - 1	4.08	0.72	0.81	24
<i>Oenothera coronopifolia</i>	0.04	0.09	0 - 1	4.08	0.72	0.81	24
<i>Psoralea tenuiflora</i>	0.24	0.55	0 - 4	12.24	2.16	2.70	15
<i>Senecio spartioides</i>	0.02	0.05	0 - 1	2.04	0.36	0.41	28
<i>Senecio tridenticulatus</i>	0.02	0.05	0 - 1	2.04	0.36	0.41	28
<i>Sphaeralcea coccinea</i>	0.22	0.50	0 - 2	14.29	2.52	3.02	13
Sub-total	1.00	2.23					
ANNUAL AND BIENNIAL FORBS							
<i>Conyza canadensis</i>	0.10	0.23	0 - 3	6.12	1.08	1.31	21
<i>Erigeron divergens</i>	0.94	2.09	0 - 12	28.57	5.04	7.13	7
<i>Hedeoma hispidum</i>	0.10	0.23	0 - 5	2.04	0.36	0.59	25
<i>Lactuca serriola</i>	0.33	0.73	0 - 4	12.24	2.16	2.89	14
<i>Melilotus officinalis</i>	0.86	1.91	0 - 14	16.33	2.88	4.79	9
<i>Plantago patagonica</i>	0.06	0.14	0 - 1	6.12	1.08	1.22	22
Sub-total	2.39	5.33					
SEMI-SHRUBS OR HALF-SHRUBS							
<i>Artemisia frigida</i>	0.59	1.32	0 - 9	14.29	2.52	3.84	10
<i>Gutierrezia sarothrae</i>	0.06	0.14	0 - 3	2.04	0.36	0.50	26
Sub-total	0.65	1.46					
SHRUBS							
<i>Ceratoides lanata</i>	0.02	0.05	0 - 1	2.04	0.36	0.41	28

Table 47. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
Chrysothamnus nauseosus	0.14	0.32	0 - 2	10.20	1.80	2.12	16
Sub-total	0.16	0.36					
CACTI AND SUCCULENTS							
Opuntia polyacantha	0.06	0.14	0 - 1	6.12	1.08	1.22	22
Sub-total	0.06	0.14					
SUM OF SPECIES COVER	44.84						
TOTAL VEGETATION	44.84 +/-	16.09					
LITTER/ROCK	47.10 +/-	14.94					
DARE SOIL	8.06 +/-	7.15					
TOTAL COVER	91.94 +/-	7.15					
Number of Species/sample	5.67						

Table 48. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE CRESTED WHEATGRASS TYPE AT BUCKLEY FIELD. 1986 DATA.

HEIGHTS OF MAJOR SPECIES			
SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS			
Agropyron smithii	28	6	8
WARM SEASON PERENNIAL GRASSES			
Sporobolus cryptandrus	27		1
INTRODUCED PERENNIAL GRASSES			
Agropyron desertorum	37	9	46
ANNUAL GRASSES			
Bromus japonicus	30	3	5
Bromus tectorum	28	7	3
ANNUAL AND BIENNIAL FORBS			
Melilotus officinalis	100	18	3
SEMI-SHRUBS			
Artemisia frigida	36		1
DENSITY OF WOODY SPECIES AND CACTI (Sample size = 49)			
SPECIES	NUMBER/HECTARE	STANDARD DEVIATION	
Ceratoides lanata	39	271	
Chrysothamnus nauseosus	76	217	
Coryphantha vivipara	4	29	
Opuntia polyacantha	406	898	
TOTAL	525	1206	

Table 49.

PRODUCTION SUMMARY FOR THE CRESTED WHEATGRASS  
TYPE AT BUCKLEY FIELD. BASED ON 1986 DATA FROM 49  
SAMPLING LOCATIONS. +/- VALUES EQUAL THE STANDARD  
DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	21.65	0.00 - 198.07	20.11
Aristida longiseta	0.41	0.00 - 9.02	0.38
Schedonnardus paniculatus	0.29	0.00 - 8.15	0.27
Stipa comata	0.05	0.00 - 2.57	0.05
Sub-total	22.41		20.81
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	0.41	0.00 - 18.74	0.38
Buchloe dactyloides	1.63	0.00 - 46.38	1.51
Sporobolus cryptandrus	0.60	0.00 - 4.53	0.56
Sub-total	2.64		2.45
INTRODUCED PERENNIAL GRASSES			
Agropyron desertorum	77.11	0.00 - 187.30	71.61
Bromopsis inermis	0.01	0.00 - 0.28	0.01
Sub-total	77.11		71.62
ANNUAL GRASSES			
Bromus japonicus	0.46	0.00 - 7.85	0.43
Bromus tectorum	0.41	0.00 - 13.81	0.38
Vulpia octoflora	0.00	0.00 - 0.01	0.00
Sub-total	0.87		0.81
PERENNIAL FORBS			
Aster falcatus	0.24	0.00 - 11.93	0.23
Convolvulus arvensis	0.30	0.00 - 7.85	0.28
Evolvulus nuttallianus	0.00	0.00 - 0.24	0.00
Heterotheca villosa	0.09	0.00 - 4.55	0.09
Kuhnia eupatorioides	0.01	0.00 - 0.42	0.01
Oenothera coronopifolia	0.00	0.00 - 0.09	0.00
Psoralea tenuiflora	0.01	0.00 - 0.73	0.01
Sphaeralcea coccinea	0.07	0.00 - 1.33	0.06
Tragopogon dubius	0.02	0.00 - 0.66	0.02
Sub-total	0.75		0.70
ANNUAL AND BIENNIAL FORBS			
Alyssum minus	0.07	0.00 - 2.73	0.07

able 49 (cont'd).

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
<i>Conyza canadensis</i>	0.02	0.00 - 0.51	0.01
<i>Erigeron divergens</i>	1.89	0.00 - 17.69	1.76
<i>Hedeoma hispidum</i>	0.23	0.00 - 8.21	0.22
<i>Lactuca serriola</i>	0.02	0.00 - 0.85	0.02
<i>Lepidium densiflorum</i>	0.02	0.00 - 0.89	0.02
<i>Melilotus alba</i>	0.39	0.00 - 18.78	0.36
<i>Melilotus officinalis</i>	0.82	0.00 - 33.29	0.76
<i>Plantago patagonica</i>	0.15	0.00 - 2.92	0.14
Sub-total	3.61		3.35
SEMI-SHRUBS OR HALF-SHRUBS			
<i>Artemisia frigida</i>	0.28	0.00 - 13.89	0.26
TOTAL PRODUCTION	107.67	+/- 36.12	

LIST OF SPECIES OBSERVED GROWING IN THE CRESTED WHEATGRASS  
TYPE AT BUCKLEY FIELD. BASED ON OBSERVATIONS MADE DURING  
THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Koeleria macrantha</i>	Prairie Junegrass	Gramineae
<i>Muhlenbergia asperifolia</i>	Alkali Muhly	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<i>Stipa viridula</i>	Green Needle Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Ipobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Agropyron elongatum</i>	Tall Wheatgrass	Gramineae
<i>Agropyron intermedium</i>	Intermediate Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Secale cereale</i>	Rye	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Allium textile</i>	Prairie Onion	Liliaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Asclepias pumilus</i>	Little Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus bisulcatus</i>	Two-grooved Milkvetch	Leguminosae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erigeron pumilus</i>	Daisy Fleabane	Compositae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae

Scientific Name	Common Name	Family Name
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Iva axillaris</i>	Poverty Sumpweed	Compositae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Lathyrus eucosmus</i>	Peavine	Leguminosae
<i>Lithospermum incisum</i>	Narrowleaf Gromwell	Boraginaceae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Orobanche fasciculata</i>	Cancer Root	Orobanchaceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Penstemon albidus</i>	White Beardtongue	Scrophulariaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Picradeniopsis oppositifolia</i>	Plains Bahia	Compositae
<i>Purpurea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Ratibida columnifera</i>	Prairie Coneflower	Compositae
<i>Rumex crispus</i>	Curly Dock	Polygonaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Solidago missouriensis</i>	Missouri Goldenrod	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae

#### ANNUAL AND BIENNIAL FORBS

<i>Alyssum minus</i>	Alyssum	Cruciferae
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Carduus nutans ssp. macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Descurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Dyssodia papposa</i>	Petid Marigold	Compositae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Geranium hispidum</i>	False Pennyroyal	Labiatae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Kochia iranica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae

Scientific Name	Common Name	Family Name
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Thlaspi arvense</i>	Field Pennycress	Cruciferae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
<i>Artemisia ludoviciana</i>	Louisiana Sagewort	Compositae
<i>Gerardia sarothrae</i>	Broom Snakeweed	Compositae
SHRUBS		
<i>Caragana arborescens</i>	Siberian Pea Shrub	Leguminosae
<i>Ceratoides lanata</i>	Winterfat	Chenopodiaceae
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
<i>Coryphantha vivipara</i>	Ball Cactus	Cactaceae
<i>Opuntia compressa</i>	Prickly Pear Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
TREES		
<i>Elaeagnus angustifolia</i>	Russian Olive	Elaeagnaceae
<i>Gleditsia triacanthos</i>	Honey Locust	Leguminosae
<i>Robinia neomexicana</i>	New Mexico Black Locust	Leguminosae



Table 51

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE WEEDY  
FORB TYPE AT BUCKLEY FIELD. BASED ON DATA FROM 10 SAMPLING  
LOCATIONS. 1986 DATA. +/- VALUES EQUAL THE STANDARD  
DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>ANNUAL GRASSES</b>							
<i>Bromus tectorum</i>	4.20	8.27	0 - 24	50.00	12.50	20.77	2
Sub-total	4.20	8.27					
<b>PERENNIAL FORBS</b>							
<i>Aster falcatus</i>	0.40	0.79	0 - 2	20.00	5.00	5.79	6
<i>Convolvulus arvensis</i>	35.80	70.47	0 - 56	90.00	22.50	92.97	1
<i>Kuhnia eupatorioides</i>	0.80	1.57	0 - 4	20.00	5.00	6.57	5
<i>Physalis heterophylla</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
<i>Picradentopsis oppositifolia</i>	0.40	0.79	0 - 4	10.00	2.50	3.29	7
<i>Solidago missouriensis</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
<i>Sphaeralcea coccinea</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
Sub-total	36.00	74.80					
<b>ANNUAL AND BIENNIAL FORBS</b>							
<i>Amaranthus albus</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
<i>Chamaesyce glyptosperma</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
<i>Kochia iranica</i>	3.20	6.30	0 - 10	40.00	10.00	16.30	3
<i>Machaeranthera canescens</i>	1.20	2.36	0 - 10	20.00	5.00	7.36	4
<i>Portulaca oleracea</i>	0.40	0.79	0 - 4	10.00	2.50	3.29	7
<i>Sisymbrium altissimum</i>	0.40	0.79	0 - 4	10.00	2.50	3.29	7
<i>Solanum triflorum</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
<i>Verbena bracteata</i>	0.20	0.39	0 - 2	10.00	2.50	2.89	8
<i>Verbesina encelioides</i>	1.20	2.36	0 - 8	20.00	5.00	7.36	4
Sub-total	7.40	14.57					
<b>SEMI-SHRUBS OR HALF-SHRUBS</b>							
<i>Artemisia ludoviciana</i>	0.40	0.79	0 - 4	10.00	2.50	3.29	7
Sub-total	0.40	0.79					

Table 51. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>SHRUBS</b>							
<i>Chrysothamnus nauseosus</i>	0.80	1.57	0 - 6	20.00	5.00	6.57	5
Sub-total	0.80	1.57					
SUM OF SPECIES COVER	50.80						
LITTER	34.20		18 - 52	100.00			
TOTAL VEGETATION	50.80 +/-	13.86					
LITTER/ROCK	34.20 +/-	9.95					
DARE SOIL	15.00 +/-	11.13					
TOTAL COVER	85.00 +/-	11.13					
Number of Species/sample	4.00						

Table 52. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE WEEDY FORB TYPE AT BUCKLEY FIELD. 1986 DATA.

HEIGHTS OF MAJOR SPECIES			
SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
ANNUAL GRASSES			
<i>Bromus tectorum</i>	15	5	2
PERENNIAL FORBS			
<i>Convolvulus arvensis</i>	9	2	9
SHRUBS			
<i>Chrysothamnus nauseosus</i>	21		1
DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)			
SPECIES	NUMBER/HECTARE	STANDARD DEVIATION	
<i>Chrysothamnus nauseosus</i>	200	445	
TOTAL	200	445	

Table 55

HEIGHTS OF PLANTS

SPECIES

COOL SEASON

Agropyron

DENSITY OF PLANTS

SPECIES

Ceratophyllum  
Chrysanthemum  
Opuntia  
Salix

Common Name	Family Name
Winged Dock	Polygonaceae
Missouri Goldenrod	Compositae
Scarlet Globe Mallow	Malvaceae
Wormsif	Compositae
Star Speedwell	Scrophulariaceae
Amaranth	Amaranthaceae
Spiny Thistle	Compositae
Groundsfoot	Chenopodiaceae
Spiny Thistle	Compositae
Spinyweed	Compositae
Richardson Tansy Mustard	Cruciferae
Yellow Herb	Onagraceae
Single-flowered Gaura	Onagraceae
Annual Sunflower	Compositae
Spiny Elder	Compositae
Spiny Lettuce	Compositae
Yellow Sweetclover	Leguminosae
Asian Thistle	Chenopodiaceae
Spiny	Labiatae
Spiny Hedge Mustard	Cruciferae
Spiny Daisy	Compositae
Spiny	Compositae
Missiana Sagewort	Compositae
Spiny	Chenopodiaceae
Spiny Rabbitbrush	Compositae
Spiny Rose	Rosaceae
Spiny Willow	Salicaceae
Spiny	Tamaricaceae
Spiny Prickly Pear	Cactaceae
Spiny Cottonwood	Salicaceae
Spiny Cottonwood	Salicaceae
Spiny-leaved Willow	Salicaceae

Table 56 .(cont'd.)

Scientific Name	Common Name	Family Name
Ulmus pumila	Chinese Elm	Ulmaceae

Table 7.

COVER: FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE MIXED  
GRASS PRAIRIE TYPE AT THE PLAINS CONSERVATION CENTER. BASED  
ON DATA FROM 51 SAMPLING LOCATIONS. 1986 DATA. +/- VALUES  
EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
<i>Agropyron smithii</i>	31.06	44.46	0 - 58	100.00	13.67	58.13	1
<i>Aristida longiseta</i>	1.57	2.25	0 - 8	62.75	8.58	10.82	6
<i>Poa sandbergii</i>	0.02	0.03	0 - 1	1.96	0.27	0.30	23
<i>Schedonnardus paniculatus</i>	0.14	0.20	0 - 5	5.88	0.80	1.00	19
<i>Sitanion longifolium</i>	0.06	0.08	0 - 2	3.92	0.54	0.62	21
<i>Stipa comata</i>	2.29	3.28	0 - 22	35.29	4.83	8.11	8
<i>Stipa viridula</i>	1.78	2.55	0 - 26	17.65	2.41	4.97	9
Sub-total	36.92	52.85					
WARM SEASON PERENNIAL GRASSES							
<i>Bouteloua gracilis</i>	2.29	3.28	0 - 10	56.86	7.77	11.06	5
<i>Buchloe dactyloides</i>	0.35	0.51	0 - 9	7.84	1.07	1.58	15
<i>Sporobolus cryptandrus</i>	2.67	3.82	0 - 13	72.55	9.92	13.74	4
Sub-total	5.31	7.61					
INTRODUCED PERENNIAL GRASSES							
<i>Poa pratensis</i>	0.08	0.11	0 - 2	5.88	0.80	0.92	20
Sub-total	0.08	0.11					
ANNUAL GRASSES							
<i>Bromus japonicus</i>	9.16	13.11	0 - 31	82.35	11.26	24.37	3
<i>Bromus tectorum</i>	14.53	20.80	0 - 56	84.31	11.53	32.33	2
Sub-total	23.69	33.90					
PERENNIAL FORBS							
<i>Ambrosia psilostachya</i>	0.02	0.03	0 - 1	1.96	0.27	0.30	23
<i>Aster falcatus</i>	0.04	0.06	0 - 1	3.92	0.54	0.59	22

Table 57. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I. V.	Rank
<i>Heterotheca villosa</i>	0.12	0.17	0 - 1	11.76	1.61	1.78	14
<i>Kuhnia eupatorioides</i>	0.02	0.03	0 - 1	1.96	0.27	0.30	23
<i>Lygodesmia juncea</i>	0.02	0.03	0 - 1	1.96	0.27	0.30	23
<i>Psoralea tenuiflora</i>	0.61	0.87	0 - 7	29.41	4.02	4.89	10
<i>Ratibida columnifera</i>	0.04	0.06	0 - 1	3.92	0.54	0.59	22
<i>Sphaeralcea coccinea</i>	0.12	0.17	0 - 2	9.80	1.34	1.51	16
<i>Thelesperma megapotamicum</i>	0.02	0.03	0 - 1	1.96	0.27	0.30	23
Sub-total	1.00	1.43					
ANNUAL AND BIENNIAL FORBS							
<i>Eriogon divergens</i>	0.10	0.14	0 - 1	9.80	1.34	1.48	17
<i>Hedeoma hispidum</i>	0.37	0.53	0 - 5	17.65	2.41	2.95	11
Sub-total	0.47	0.67					
SEMI-SHRUBS OR HALF-SHRUBS							
<i>Artemisia frigida</i>	1.73	2.47	0 - 13	56.86	7.77	10.24	7
<i>Artemisia ludoviciana</i>	0.02	0.03	0 - 1	1.96	0.27	0.30	23
<i>Gutierrezia sarothrae</i>	0.22	0.31	0 - 5	11.76	1.61	1.92	13
Sub-total	1.96	2.81					
SHRUBS							
<i>Chrysothamnus nauseosus</i>	0.20	0.28	0 - 2	13.73	1.88	2.16	12
Sub-total	0.20	0.28					
CACTI AND SUCCULENTS							
<i>Opuntia polyacantha</i>	0.12	0.17	0 - 3	7.84	1.07	1.24	18
<i>Yucca glauca</i>	0.12	0.17	0 - 2	7.84	1.07	1.24	18
Sub-total	0.24	0.34					



Table 57-(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
SUM OF SPECIES COVER	69.86						
TOTAL VEGETATION	69.86 +/-	10.52					
LITTER/ROCK	29.94 +/-	10.48					
BARE SOIL	0.20 +/-	0.72					
TOTAL COVER	99.80 +/-	0.72					
Number of Species/sample	7.31						

Table 19.

PRODUCTION SUMMARY FOR THE MIDGRASS PRAIRIE TYPE  
AT THE PLAINS CONSERVATION CENTER. BASED ON 1986  
DATA FROM 51 SAMPLING LOCATIONS. +/- VALUES EQUAL  
THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	49.93	0.00 - 148.03	46.73
Aristida longiseta	2.75	0.00 - 27.02	2.58
Carex filifolia	0.14	0.00 - 5.41	0.13
Koeleria macrantha	0.01	0.00 - 0.37	0.01
Poa sandbergii	0.26	0.00 - 12.02	0.24
Schedonnardus paniculatus	0.29	0.00 - 3.62	0.27
Sitanion longifolium	0.10	0.00 - 5.33	0.10
Stipa comata	7.04	0.00 - 97.09	6.59
Stipa viridula	3.71	0.00 - 50.42	3.48
Sub-total	64.22		60.11
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	3.19	0.00 - 40.27	2.98
Buchloe dactyloides	2.03	0.00 - 32.41	1.90
Sporobolus cryptandrus	5.91	0.00 - 65.58	5.53
Sub-total	11.13		10.42
INTRODUCED PERENNIAL GRASSES			
Poa pratensis	0.09	0.00 - 4.63	0.08
ANNUAL GRASSES			
Bromus japonicus	10.02	0.00 - 52.02	9.38
Bromus tectorum	8.72	0.00 - 57.46	8.16
Vulpia octoflora	0.07	0.00 - 1.93	0.07
Sub-total	18.81		17.60
PERENNIAL FORBS			
Aster falcatus	0.05	0.00 - 2.58	0.05
Astragalus drummondii	0.00	0.00 - 0.23	0.00
Astragalus missouriensis	0.21	0.00 - 10.56	0.19
Comandra umbellata	0.05	0.00 - 2.34	0.05
Erysimum asperum	0.22	0.00 - 7.30	0.20
Evolvulus nuttallianus	0.12	0.00 - 3.92	0.12
Gaura coccinea	0.03	0.00 - 1.25	0.03
Grindelia squarrosa	0.02	0.00 - 1.10	0.02
Heterotheca villosa	0.20	0.00 - 6.84	0.18

Table 59.(cont'd).

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
Lithospermum incisum	0.00	0.00 - 0.22	0.00
Lygodesmia juncea	0.25	0.00 - 12.77	0.23
Oenothera coronopifolia	0.42	0.00 - 21.39	0.40
Orobanche fasciculata	0.05	0.00 - 1.23	0.05
Oxybaphus linearis	0.02	0.00 - 0.47	0.02
Penstemon albidus	0.01	0.00 - 0.50	0.01
Physalis hederifolia	0.01	0.00 - 0.36	0.01
Psoralea tenuiflora	1.91	0.00 - 38.95	1.79
Senecio tridenticulatus	0.01	0.00 - 0.34	0.01
Sphaeralcea coccinea	1.08	0.00 - 5.89	1.01
Thelesperma megapotamicum	0.01	0.00 - 0.58	0.01
Tragopogon dubius	0.51	0.00 - 6.09	0.48
Sub-total	5.20		4.86
ANNUAL AND BIENNIAL FORBS			
Alyssum minus	0.11	0.00 - 2.77	0.10
Conyza canadensis	0.02	0.00 - 0.42	0.02
Descurainia richardsonii	0.01	0.00 - 0.54	0.01
Erigeron divergens	0.83	0.00 - 7.35	0.78
Hedeoma hispidum	0.61	0.00 - 9.35	0.57
Lactuca serriola	0.26	0.00 - 6.58	0.24
Lepidium densiflorum	0.10	0.00 - 2.82	0.09
Plantago patagonica	0.11	0.00 - 1.68	0.10
Sisymbrium altissimum	0.08	0.00 - 4.21	0.08
Verbena bracteata	0.05	0.00 - 2.30	0.04
Sub-total	2.17		2.03
SEMI-SHRUBS OR HALF-SHRUBS			
Artemisia frigida	5.10	0.00 - 38.59	4.77
Gutierrezia sarothrae	0.12	0.00 - 3.05	0.11
Sub-total	5.22		4.88
TOTAL PRODUCTION	106.83	+/- 32.90	
TOTAL PRODUCTION Corrected for Grazing Damage to Cages	110.39	+/- 34.54	

Table 60.

LIST OF SPECIES OBSERVED GROWING IN THE MIDGRASS PRAIRIE  
TYPE AT THE PLAINS CONSERVATION CENTER. BASED ON  
OBSERVATIONS MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Aristida fendleriana</i>	Fendler Three-awn	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Carex filifolia</i>	Threadleaf Sedge	Cyperaceae
<i>Koeleria macrantha</i>	Prairie Junegrass	Gramineae
<i>Oryzopsis hymenoides</i>	Indian Ricegrass	Gramineae
<i>Poa sandbergii</i>	Sandberg Bluegrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<i>Stipa viridula</i>	Green Needle Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Muhlenbergia torreyi</i>	Ring Muhly	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Agropyron desertorum</i>	Fairway Wheatgrass	Gramineae
<i>Bromopsis inermis</i>	Smooth Brome	Gramineae
<i>Phleum pratense</i>	Timothy	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Achillea lanulosa</i>	Western Yarrow	Compositae
<i>Allium textile</i>	Prairie Onion	Liliaceae
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Antennaria rosea</i>	Pussytoes	Compositae
<i>Arabis fendleri</i>	Rockcress	Cruciferae
<i>Argemone polyanthemus</i>	Prickly Poppy	Papaveraceae
<i>Asclepias pumilus</i>	Little Milkweed	Asclepiadaceae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus bisulcatus</i>	Two-grooved Milkvetch	Leguminosae
<i>Astragalus crassicaupus</i>	Ground Plum	Leguminosae

Table 60. (cont'd.)

Scientific Name	Common Name	Family Name
<i>Astragalus dasyglottis</i>	Purple Milk Vetch	Leguminosae
<i>Astragalus drummondii</i>	Drummond Milkvetch	Leguminosae
<i>Astragalus flexuosus</i>	Wiry Milkvetch	Leguminosae
<i>Astragalus missouriensis</i>	Missouri Milkvetch	Leguminosae
<i>Castilleja integra</i>	Plains Indian Paintbrush	Scrophulariaceae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Comandra umbellata</i>	Bastard Toadflax	Santalaceae
<i>Erysimum asperum</i>	Western Wallflower	Cruciferae
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Lesquerella ludoviciana</i>	Bladderpod	Cruciferae
<i>Liatris punctata</i>	Gay Feather	Compositae
<i>Lithospermum incisum</i>	Narrowleaf Gromwell	Boraginaceae
<i>Lomatium orientale</i>	Salt and Pepper	Umbelliferae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Machaeranthera pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Mertensia lanceolata</i>	Narrow-leaved Mertensia	Boraginaceae
<i>Musineon divaricatum</i>	Musineon	Umbelliferae
<i>Nothocalais cuspidata</i>	False Dandelion	Compositae
<i>Oenothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Orobanche fasciculata</i>	Cancer Root	Orobanchaceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Oxytropis sericea</i>	Woolly Locoweed	Leguminosae
<i>Penstemon albidus</i>	White Beardtongue	Scrophulariaceae
<i>Penstemon secundiflorus</i>	One-sided Penstemon	Scrophulariaceae
<i>Phlox longifolia</i>	Long-leaved Phlox	Polemoniaceae
<i>Physalis hederacfolia</i>	Ground Cherry	Solanaceae
<i>Physalis heterophylla</i>	Ground Cherry	Solanaceae
<i>Physalis virginiana</i>	Ground Cherry	Solanaceae
<i>Picradeniopsis oppositifolia</i>	Plains Bahia	Compositae
<i>Psoralea lanceolata</i>	Narrowleaf Scurfpea	Leguminosae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Ratibida columnifera</i>	Prairie Coneflower	Compositae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Solidago missouriensis</i>	Missouri Goldenrod	Compositae
<i>Solidago mollis</i>	Soft Goldenrod	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae

Scientific Name	Common Name	Family Name
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Thelesperma megapotamicum</i>	Thelesperma	Compositae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<i>Vicia americana</i>	American Vetch	Leguminosae
<i>Viola nuttallii</i>	Nuttall Violet	Violaceae
ANNUAL AND BIENNIAL FORBS		
<i>Alyssum minus</i>	Alyssum	Cruciferae
<i>Amaranthus graecizans</i>	Prostrate Pigweed	Amaranthaceae
<i>Camelina microcarpa</i>	Littleseed Falseflax	Cruciferae
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce serpyllifolia</i>	Thyme-leaved Spurge	Euphorbiaceae
<i>Chenopodium album</i>	Goosefoot	Chenopodiaceae
<i>Chenopodium leptophyllum</i>	Narrowleaf Goosefoot	Chenopodiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Collomia linearis</i>	Collomia	Polemoniaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Descurainia pinnata</i>	Tansy Mustard	Cruciferae
<i>Descurainia richardsonii</i>	Richardson Tansy Mustard	Cruciferae
<i>Descurainia sophia</i>	Flixweed	Cruciferae
<i>Draba reptans</i>	White Draba	Cruciferae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Erodium cicutarium</i>	Filaree	Geraniaceae
<i>Gaura parviflora</i>	Little-flowered Gaura	Onagraceae
<i>Hedeoma hispidum</i>	False Pennyroyal	Labiatae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Kochia iberica</i>	Summer Cypress	Chenopodiaceae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Microsteris gracilis</i>	Microsteris	Polemoniaceae
<i>Oenothera albicaulis</i>	Prairie Evening Primrose	Onagraceae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Podospermum laciniatum</i>	Podospermum	Compositae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Salsola iberica</i>	Russian Thistle	Chenopodiaceae
<i>Sisymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum rostratum</i>	Buffalo Bur	Solanaceae
<i>Thlaspi arvense</i>	Field Pennycress	Cruciferae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Verbesina encelioides</i>	Cow-pen Daisy	Compositae

Scientific Name	Common Name	Family Name
<b>SEMI-SHRUBS OR HALF-SHRUBS</b>		
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
<i>Artemisia ludoviciana</i>	Louisiana Sagewort	Compositae
<i>Gutierrezia sarothrae</i>	Broom Snakeweed	Compositae
<i>Leptodactylon pungens</i>	Prickly Gilia	Polemoniaceae
<b>SHRUBS</b>		
<i>Caragana arborescens</i>	Siberian Pea Shrub	Leguminosae
<i>Ceratoides lanata</i>	Winterfat	Chenopodiaceae
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
<i>Ribes aureum</i>	Golden Currant	Grossulariaceae
<b>CACTI AND SUCCULENTS</b>		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae
<b>TREES</b>		
<i>Elaeagnus angustifolia</i>	Russian Olive	Elaeagnaceae

Table 61.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
SHORTGRASS PRAIRIE TYPE AT THE PLAINS CONSERVATION CENTER.  
BASED ON DATA FROM 52 SAMPLING LOCATIONS 1986 DATA. +/-  
VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
<i>Agropyron smithii</i>	16.15	25.27	0 - 43	98.08	10.16	35.43	2
<i>Aristida longiset</i>	0.81	1.26	0 - 10	36.54	3.78	5.05	12
<i>Carex filifolia</i>	0.04	0.06	0 - 2	1.92	0.20	0.26	27
<i>Koeleria macrantha</i>	0.35	0.54	0 - 2	25.00	2.59	3.13	15
<i>Poa sandbergii</i>	9.06	0.09	0 - 1	5.77	0.60	0.69	22
<i>Sitanion longifolium</i>	1.04	1.62	0 - 12	36.54	3.78	5.41	11
<i>Stipa comata</i>	0.21	0.33	0 - 5	7.69	0.80	1.13	19
<i>Stipa viridula</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28
Sub-total	18.67	29.21					
WARM SEASON PERENNIAL GRASSES							
<i>Bouteloua gracilis</i>	18.50	28.94	0 - 47	94.23	9.76	38.70	1
<i>Buchloe dactyloides</i>	5.94	9.30	0 - 33	78.85	8.17	17.46	4
<i>Sporobolus cryptandrus</i>	0.12	0.18	0 - 2	9.62	1.00	1.18	18
Sub-total	24.56	38.42					
ANNUAL GRASSES							
<i>Bromus japonicus</i>	2.90	4.54	0 - 27	50.00	5.18	9.72	7
<i>Bromus tectorum</i>	7.67	12.00	0 - 35	84.62	8.76	20.77	3
<i>Vulpia octoflora</i>	0.12	0.18	0 - 2	9.62	1.00	1.18	18
Sub-total	10.69	16.73					
PERENNIAL FORBS							
<i>Aster falcatus</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28
<i>Erysimum asperum</i>	0.04	0.06	0 - 1	3.85	0.40	0.46	26
<i>Evolvulus nuttallianus</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28
<i>Grindelia squarrosa</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28



Table 61. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Heterotheca villosa</i>	0.23	0.36	0 - 2	19.23	1.99	2.35	16
<i>Oxybaphus linearis</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28
<i>Picradenloopsis oppositifolia</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28
<i>Psoralea tenuiflora</i>	1.06	1.65	0 - 8	36.54	3.78	5.44	10
<i>Senecio tridenticulatus</i>	0.10	0.15	0 - 4	3.85	0.40	0.55	24
<i>Sphaeralcea coccinea</i>	0.10	0.15	0 - 2	7.69	0.80	0.95	21
Sub-total	1.62	2.53					
ANNUAL AND BIENNIAL FORBS							
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28
<i>Erigeron divergens</i>	0.15	0.24	0 - 2	13.46	1.39	1.64	17
<i>Hedeoma hispidum</i>	0.50	0.78	0 - 6	25.00	2.59	3.37	14
<i>Plantago patagonica</i>	0.12	0.18	0 - 3	7.69	0.80	0.98	20
Sub-total	0.79	1.23					
SEMI-SHRUBS OR HALP-SHRUBS							
<i>Artemisia frigida</i>	2.48	3.88	0 - 9	78.85	8.17	12.05	5
<i>Artemisia ludoviciana</i>	0.08	0.12	0 - 3	3.85	0.40	0.52	25
<i>Gutierrezia sarothrae</i>	0.69	1.08	0 - 4	44.23	4.58	5.66	9
Sub-total	3.25	5.08					
SHRUBS							
<i>Ceratoides lanata</i>	0.02	0.03	0 - 1	1.92	0.20	0.23	28
<i>Chrysothamnus nauseosus</i>	1.87	2.92	0 - 9	65.38	6.77	9.69	8
<i>Eriogonum effusum</i>	0.40	0.63	0 - 4	26.92	2.79	3.42	13
Sub-total	2.29	3.58					
CACTI AND SUCCULENTS							
<i>Opuntia polyacantha</i>	1.94	3.04	0 - 8	71.15	7.37	10.41	6

Table 61. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<i>Yucca glauca</i>	0.12	0.18	0 -	5	3.85	0.58	23
Sub-total	2.06	3.22					
SUM OF SPECIES COVER	63.92						
TOTAL VEGETATION	63.92 +/-	15.34					
LITTER/ROCK	34.17 +/-	13.85					
BARE SOIL	1.90 +/-	2.74					
TOTAL COVER	98.10 +/-	2.74					
Number of Species/sample	9.65						

Table 62. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE SHORTGRASS PRAIRIE TYPE AT THE PLAINS CONSERVATION CENTER. 1986 DATA.

HEIGHTS OF MAJOR SPECIES

SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
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COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS

<i>Agropyron smithii</i>	24	4	50
<i>Aristida longiseta</i>	20		1

ANNUAL GRASSES

<i>Bromus tectorum</i>	23	4	33
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SEMI-SHRUBS

<i>Artemisia frigida</i>	11	3	3
<i>Gutierrezia sarothrae</i>	15		1

SHRUBS

<i>Chrysothamnus nauseosus</i>	20	4	7
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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 55)

SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
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<i>Ceratoides lanata</i>	107	246
<i>Chrysothamnus nauseosus</i>	2586	2015
<i>Coryphantha vivipara</i>	171	442
<i>Eriogonum effusum</i>	1089	1346
<i>Opuntia polyacantha</i>	10222	6716
<i>Yucca glauca</i>	35	114
TOTAL	14155	8667

Table 63.

PRODUCTION SUMMARY FOR THE SHORTGRASS PRAIRIE  
TYPE AT THE PLAINS CONSERVATION CENTER. BASED ON  
1986 DATA FROM 51 SAMPLING LOCATIONS. +/- VALUES  
EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	13.72	0.00 - 94.62	16.44
Agropyron trachycaulum	0.01	0.00 - 0.35	0.01
Aristida longiseta	0.74	0.00 - 19.46	0.88
Carex eleocharis	0.41	0.00 - 21.13	0.50
Carex filifolia	0.51	0.00 - 9.05	0.61
Koeleria macrantha	1.02	0.00 - 14.34	1.22
Poa sandbergii	0.15	0.09 - 1.05	0.18
Schedonnardus paniculatus	0.23	0.00 - 4.41	0.27
Sitanion longifolium	1.36	0.00 - 12.11	1.62
Stipa comata	1.95	0.00 - 85.61	2.33
Sub-total	20.09		24.07
WARM SEASON PERENNIAL GRASSES			
Bouteloua gracilis	20.37	0.00 - 57.65	24.40
Buchloe dactyloides	10.59	0.00 - 39.73	12.68
Sporobolus cryptandrus	0.20	0.00 - 2.88	0.24
Sub-total	31.15		37.33
INTRODUCED PERENNIAL GRASSES			
Phleum pratense	0.01	0.00 - 0.61	0.01
Poa pratensis	0.02	0.00 - 0.68	0.02
Sub-total	0.03		0.03
ANNUAL GRASSES			
Bromus japonicus	4.93	0.02 - 54.23	5.91
Bromus tectorum	5.39	0.00 - 63.95	6.46
Vulpia octoflora	0.62	0.00 - 10.12	0.75
Sub-total	10.95		13.11
PERENNIAL FORBS			
Astragalus dasyglottis	0.65	0.00 - 21.86	0.77
Astragalus missouriensis	0.17	0.00 - 5.89	0.20
Erigeron pumilus	0.12	0.00 - 6.02	0.14
Erysimum asperum	0.24	0.00 - 3.87	0.29
Evolvulus nuttallianus	0.06	0.00 - 1.52	0.07
Gaura coccinea	0.06	0.00 - 1.15	0.07

able 63. (cont'd).

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
Grindelia squarrosa	1.11	0.00 - 22.62	1.32
Heterotheca villosa	1.53	0.00 - 33.91	1.83
Lithospermum incisum	0.01	0.00 - 0.74	0.02
Lygodesmia juncea	0.14	0.00 - 4.60	0.17
Machaeranthera pinnatifida	0.09	0.00 - 2.89	0.10
Oenothera coronopifolia	0.01	0.00 - 0.34	0.01
Orobanche fasciculata	0.02	0.00 - 0.65	0.03
Oxybaphus linearis	0.03	0.00 - 0.72	0.04
Penstemon albidus	0.17	0.00 - 6.81	0.20
Psoralea tenuiflora	1.92	0.00 - 31.51	2.30
Ratibida columnifera	0.70	0.00 - 35.66	0.84
Sedum lanceolatum	0.00	0.00 - 0.16	0.00
Senecio tridenticulatus	0.21	0.00 - 4.45	0.25
Sphaeralcea coccinea	0.66	0.00 - 6.49	0.79
Tragopogon dubius	0.25	0.00 - 3.95	0.30
Sub-total	8.15		9.77
ANNUAL AND BIENNIAL FORBS			
Alyssum minus	0.00	0.00 - 0.04	0.00
Conyza canadensis	0.09	0.00 - 2.82	0.11
Erigeron divergens	1.44	0.00 - 10.13	1.73
Hedeoma hispidum	2.09	0.00 - 20.53	2.50
Lactuca serriola	0.13	0.00 - 2.29	0.16
Lappula redowskii	0.00	0.00 - 0.11	0.00
Lepidium densiflorum	0.01	0.00 - 0.16	0.01
Plantago patagonica	0.86	0.00 - 20.21	1.03
Polygonum aviculare	0.01	0.00 - 0.42	0.01
Sub-total	4.63		5.55
SEMI-SHRUBS OR HALF-SHRUBS			
Artemisia frigida	3.58	0.00 - 42.32	4.29
Gutierrezia sarothrae	1.53	0.00 - 32.15	1.84
Sub-total	5.11		6.13
SHRUBS			
Chrysothamnus nauseosus	2.34	0.00 - 49.36	2.81
Eriogonum effusum	1.01	0.00 - 11.54	1.20
Sub-total	3.35		4.01
TOTAL PRODUCTION	83.46	+/- 35.54	
TOTAL PRODUCTION Corrected for Grazing Damage to Cages	93.13	+/- 47.14	

Table 64.

LIST OF SPECIES OBSERVED GROWING IN THE SHORTGRASS PRAIRIE  
TYPE AT THE PLAINS CONSERVATION CENTER. BASED ON  
OBSERVATIONS MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Aristida longiseta</i>	Red Three-awn	Gramineae
<i>Carex eleocharis</i>	Spikerush Sedge	Cyperaceae
<i>Carex filifolia</i>	Threadleaf Sedge	Cyperaceae
<i>Koeleria macrantha</i>	Prairie Junegrass	Gramineae
<i>Poa sandbergii</i>	Sandberg Bluegrass	Gramineae
<i>Schedonnardus paniculatus</i>	Tumblegrass	Gramineae
<i>Sitanion longifolium</i>	Squirreltail Grass	Gramineae
<i>Stipa comata</i>	Needle-and-thread Grass	Gramineae
<i>Stipa viridula</i>	Green Needle Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<i>Buchloe dactyloides</i>	Buffalo Grass	Gramineae
<i>Muhlenbergia torreyi</i>	Ring Muhly	Gramineae
<i>Sporobolus cryptandrus</i>	Sand Dropseed	Gramineae
<b>INTRODUCED PERENNIAL GRASSES</b>		
<i>Phleum pratense</i>	Timothy	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Bromus tectorum</i>	Cheatgrass	Gramineae
<i>Munroa squarrosa</i>	False Buffalo Grass	Gramineae
<i>Vulpia octoflora</i>	Sixweeks Fescue	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Ambrosia psilostachya</i>	Western Ragweed	Compositae
<i>Antennaria rosea</i>	Pussytoes	Compositae
<i>Asclepias pumilus</i>	Little Milkweed	Asclepiadaceae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus bisulcatus</i>	Two-grooved Milkvetch	Leguminosae
<i>Astragalus crassicaupus</i>	Ground Plum	Leguminosae
<i>Astragalus dasyclottis</i>	Purple Milk Vetch	Leguminosae
<i>Astragalus drummondii</i>	Drummond Milkvetch	Leguminosae
<i>Astragalus missouriensis</i>	Missouri Milkvetch	Leguminosae
<i>Cirsium undulatum</i>	Prairie Thistle	Compositae
<i>Erigeron pumilus</i>	Daisy Fleabane	Compositae
<i>Erysimum asperum</i>	Western Wallflower	Cruciferae

Scientific Name	Common Name	Family Name
<i>Evolvulus nuttallianus</i>	Evolvulus	Convolvulaceae
<i>Gaura coccinea</i>	Gaura	Onagraceae
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Heterotheca villosa</i>	Golden Aster	Compositae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Liatris punctata</i>	Gay Feather	Compositae
<i>Lithospermum incisum</i>	Narrowleaf Gromwell	Boraginaceae
<i>Lomatium orientale</i>	Salt and Pepper	Umbelliferae
<i>Lygodesmia juncea</i>	Skeleton Plant	Compositae
<i>Michaeranthra pinnatifida</i>	Ironplant Goldenweed	Compositae
<i>Mentzelia nuda</i>	Evening Star	Loasaceae
<i>Musineon divaricatum</i>	Musineon	Umbelliferae
<i>Nothocalais cuspidata</i>	False Dandelion	Compositae
<i>Nothera coronopifolia</i>	Evening Primrose	Onagraceae
<i>Orobancha fasciculata</i>	Cancer Root	Orobanchaceae
<i>Oxybaphus linearis</i>	Narrowleaf Umbrellawort	Nyctaginaceae
<i>Penstemon albidus</i>	White Beardtongue	Scrophulariaceae
<i>Picradeniopsis oppositifolia</i>	Plains Bahia	Compositae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>Ratibida columnifera</i>	Prairie Coneflower	Compositae
<i>Sedum lanceolatum</i>	Stonecrop	Crassulaceae
<i>Senecio spartioides</i>	Broom Butterweed	Compositae
<i>Senecio tridenticulatus</i>	Groundsel	Compositae
<i>Solidago missouriensis</i>	Missouri Goldenrod	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Stephanomeria pauciflora</i>	Stephanomeria	Compositae
<i>Thelesperma megapotamicum</i>	Thelesperma	Compositae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Verbascum thapsus</i>	Common Mullein	Scrophulariaceae
<i>Viola nuttallii</i>	Nuttall Violet	Violaceae

#### ANNUAL AND BIENNIAL FORBS

<i>Alyssum minus</i>	Alyssum	Cruciferae
<i>Amaranthus albus</i>	White Pigweed	Amaranthaceae
<i>Amaranthus retroflexus</i>	Pigweed	Amaranthaceae
<i>Camelina microcarpa</i>	Littleseed Falseflax	Cruciferae
<i>Carduus nutans ssp. macrolepis</i>	Bristle Thistle	Compositae
<i>Chorispora tenella</i>	Common Blue Mustard	Cruciferae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Cleome serrulata</i>	Rocky Mt. Bee Plant	Capparidaceae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Draba reptans</i>	White Draba	Cruciferae

Table 64. (cont'd.)

Scientific Name	Common Name	Family Name
<i>Dyssodia papposa</i>	Fetid Marigold	Compositae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Gnaphalium exilifolium</i>	Cudweed	Compositae
<i>Hedeoma hispidum</i>	False Pennyroyal	Labiatae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Lappula redowskii</i>	Beggars-tick	Boraginaceae
<i>Lepidium densiflorum</i>	Prairie Peppergrass	Cruciferae
<i>Machaeranthera canescens</i>	Silvery Aster	Compositae
<i>Machaeranthera tanacetifolia</i>	Tansy Aster	Compositae
<i>Microsteris gracilis</i>	Microsteris	Polemoniaceae
<i>Oenothera albicaulis</i>	Prairie Evening Primrose	Onagraceae
<i>Plantago patagonica</i>	Pursh's Plantain	Plantaginaceae
<i>Podospermum laciniatum</i>	Podospermum	Compositae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Isymbrium altissimum</i>	Tumbling Hedge Mustard	Cruciferae
<i>Solanum triflorum</i>	Nightshade	Solanaceae
<i>Tribulus terrestris</i>	Puncture Vine	Zygophyllaceae
<i>Verbena bracteata</i>	Creeping Charlie	Verbenaceae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae
<i>Artemisia ludoviciana</i>	Louisiana Sagewort	Compositae
<i>Gutierrezia sarothrae</i>	Broom Snakeweed	Compositae
<i>Leptodactylon pungens</i>	Prickly Gillia	Polemoniaceae
SHRUBS		
<i>Ceratoides lanata</i>	Winterfat	Chenopodiaceae
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Eriogonum effusum</i>	Bushy Eriogonum	Polygonaceae
CACTI AND SUCCULENTS		
<i>Coryphantha vivipara</i>	Ball Cactus	Cactaceae
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Yucca glauca</i>	Spanish Bayonet	Agavaceae



Table 65.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
 BOTTOMLAND MEADOW TYPE AT THE PLAINS CONSERVATION CENTER.  
 BASED ON DATA FROM 10 SAMPLING LOCATIONS. 1986 DATA. +/-  
 VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I. V.	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
Agropyron smithii	46.80	70.27	28 - 60	100.00	21.28	91.55	1
Stipa viridula	0.60	0.90	0 - 2	30.00	6.38	7.28	6
Sub-total	47.40	71.17					
<b>WARM SEASON PERENNIAL GRASSES</b>							
Bouteloua gracilis	0.60	0.90	0 - 4	20.00	4.26	5.16	7
Sub-total	0.60	0.90					
<b>INTRODUCED PERENNIAL GRASSES</b>							
Phleum pratense	0.20	0.30	0 - 2	10.00	2.13	2.43	11
Poa pratensis	1.00	1.50	0 - 2	50.00	10.64	12.14	3
Sub-total	1.20	1.80					
<b>ANNUAL GRASSES</b>							
Bromus japonicus	9.40	14.11	0 - 22	80.00	17.02	31.14	2
Sub-total	9.40	14.11					
<b>PERENNIAL FORBS</b>							
Aster falcatus	0.60	0.90	0 - 4	20.00	4.26	5.16	7
Astragalus bisulcatus	0.20	0.30	0 - 2	10.00	2.13	2.43	11
Convolvulus arvensis	0.20	0.30	0 - 2	10.00	2.13	2.43	11
Glycyrrhiza lepidota	0.20	0.30	0 - 2	10.00	2.13	2.43	11
Solidago missouriensis	1.20	1.80	0 - 12	10.00	2.13	3.93	9
Sphaeralcea coccinea	0.40	0.60	0 - 2	20.00	4.26	4.86	8
Taraxacum officinale	0.80	1.20	0 - 4	30.00	6.38	7.58	5
Sub-total	3.60	5.41					

Table 65. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>ANNUAL AND BIENNIAL FORBS</b>							
<i>Carduus nutans</i> ssp. <i>macrocephalus</i>	3.00	4.50	0 - 20	20.00	4.26	8.76	4
<i>Conyza canadensis</i>	0.20	0.30	0 - 2	10.00	2.13	2.43	11
<i>Polygonum aviculare</i>	0.40	0.60	0 - 4	10.00	2.13	2.73	10
<i>Xanthium strumarium</i>	0.40	0.60	0 - 4	10.00	2.13	2.73	10
Sub-total	4.00	6.01					
<b>SEMI-SHRUBS OR HALF-SHRUBS</b>							
<i>Artemisia ludoviciana</i>	0.20	0.30	0 - 2	10.00	2.13	2.43	11
Sub-total	0.20	0.30					
<b>SHRUBS</b>							
<i>Rosa woodsii</i>	0.20	0.30	0 - 2	10.00	2.13	2.43	11
Sub-total	0.20	0.30					
<b>SUM OF SPECIES COVER</b>							
	66.60						
<b>LITTER</b>							
	32.60		18 - 40	100.00			
<b>TOTAL VEGETATION</b>							
	67.20 +/-	8.65					
<b>LITTER/ROCK</b>							
	32.60 +/-	8.49					
<b>BARE SOIL</b>							
	0.20 +/-	0.63					
<b>TOTAL COVER</b>							
	99.80 +/-	0.63					
Number of Species/sample	4.70						

Table 66. HEIGHTS OF MAJOR SPECIES AND DENSITY OF WOODY PLANTS AND CACTI IN THE BOTTOMLAND MEADOW TYPE AT THE PLAINS CONSERVATION CENTER. 1986 DATA.

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HEIGHTS OF MAJOR SPECIES

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SPECIES	MEAN HEIGHT (CM)	STANDARD DEVIATION	NUMBER OF OBSERVATIONS
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COOL SEASON PERENNIAL GRASSES AND GRASSLIKE PLANTS

Agropyron smithii	27	6	10
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DENSITY OF WOODY SPECIES AND CACTI (Sample size = 10)

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SPECIES	NUMBER/HECTARE	STANDARD DEVIATION
Chrysothamnus nauseosus	20	63
Opuntia polyacantha	20	63
Rosa woodsii	30	95
TOTAL	70	149

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LIST OF SPECIES OBSERVED GROWING IN THE BOTTOMLAND MEADOW  
TYPE AT THE PLAINS CONSERVATION CENTER. BASED ON  
OBSERVATIONS MADE DURING THE 1986 GROWING SEASON.

Scientific Name	Common Name	Family Name
<b>COOL SEASON PERENNIAL GRASSES</b>		
<i>Agropyron smithii</i>	Western Wheatgrass	Gramineae
<i>Agropyron trachycaulum</i>	Slender Wheatgrass	Gramineae
<i>Eleocharis macrostachya</i>	Common Spikerush	Cyperaceae
<i>Elymus canadensis</i>	Canada Wildrye	Gramineae
<i>Hordeum brachyantherum</i>	Little Barley	Gramineae
<i>Hordeum jubatum</i>	Foxtail Barley	Gramineae
<i>Juncus torreyi</i>	Torrey Rush	Juncaceae
<i>Stipa viridula</i>	Green Needle Grass	Gramineae
<b>WARM SEASON PERENNIAL GRASSES</b>		
<i>Bouteloua gracilis</i>	Blue Grama	Gramineae
<b>REDUCED PERENNIAL GRASSES</b>		
<i>Lolops cylindrica</i>	Goatgrass	Gramineae
<i>Agrostis gigantea</i>	Redtop	Gramineae
<i>Alopecurus pratensis</i>	Meadow Foxtail	Gramineae
<i>Phleum pratense</i>	Timothy	Gramineae
<i>Poa pratensis</i>	Kentucky Bluegrass	Gramineae
<b>ANNUAL GRASSES</b>		
<i>Beckmannia syzigachne</i>	Sloughgrass	Gramineae
<i>Bromus japonicus</i>	Japanese Brome	Gramineae
<i>Echinochloa crus-galli</i>	Barnyard Grass	Gramineae
<i>Panicum capillare</i>	Witchgrass	Gramineae
<i>Polypogon monspeliensis</i>	Rabbitfoot Grass	Gramineae
<b>PERENNIAL FORBS</b>		
<i>Achillea lanulosa</i>	Western Yarrow	Compositae
<i>Asclepias speciosa</i>	Showy Milkweed	Asclepiadaceae
<i>Aster ericoides</i>	Heath Aster	Compositae
<i>Aster falcatus</i>	White Aster	Compositae
<i>Astragalus bisulcatus</i>	Two-grooved Milkvetch	Leguminosae
<i>Astragalus drummondii</i>	Drummond Milkvetch	Leguminosae
<i>Astragalus purshii</i>	Woolly Milkvetch	Leguminosae
<i>Atriplex hastata</i>	Aster	Chenopodiaceae
<i>Cirsium arvense</i>	Canada Thistle	Compositae
<i>Cirsium flodmanii</i>	Flodman Thistle	Compositae
<i>Convolvulus arvensis</i>	Field Bindweed	Convolvulaceae
<i>Erysimum cheiranthoides</i>	Little Wallflower	Cruciferae
<i>Euphorbia cyparissias</i>	Spurge	Euphorbiaceae
<i>Glycyrrhiza lepidota</i>	Wild Licorice	Leguminosae

Scientific Name	Common Name	Family Name
<i>Grindelia squarrosa</i>	Curlycup Gumweed	Compositae
<i>Hippochaete laevigata</i>	Scouring Rush	Equisetaceae
<i>Kuhnia eupatorioides</i>	False Boneset	Compositae
<i>Lathyrus eucosmus</i>	Peavine	Leguminosae
<i>Onosmodium molle</i>	False Gromwell	Boraginaceae
<i>Persicaria maculata</i>	Lady's Thumb	Polygonaceae
<i>Picradeniopsis oppositifolia</i>	Plains Bahia	Compositae
<i>Potentilla norvegica</i>	Cinquefoil	Rosaceae
<i>Psoralea tenuiflora</i>	Slimflower Scurfpea	Leguminosae
<i>R. ibida columnifera</i>	Prairie Coneflower	Compositae
<i>Rorippa sinuata</i>	Cress	Cruciferae
<i>Rorippa sylvestris</i>	Cress	Cruciferae
<i>R. ex crispus</i>	Curly Dock	Polygonaceae
<i>S. dago missouriensis</i>	Missouri Goldenrod	Compositae
<i>Sphaeralcea coccinea</i>	Scarlet Globe Mallow	Malvaceae
<i>Taraxacum officinale</i>	Common Dandelion	Compositae
<i>Thermopsis rhombifolia</i>	Golden Banner	Leguminosae
<i>Tragopogon dubius</i>	Salsify	Compositae
<i>Veronica anagallis-aquatica</i>	Water Speedwell	Scrophulariaceae
ANNUAL AND BIENNIAL FORBS		
<i>Ambrosia trifida</i>	Giant Ragweed	Compositae
<i>Barbarea orthoceras</i>	Winter Cress	Cruciferae
<i>Carduus nutans ssp. macrolepis</i>	Bristle Thistle	Compositae
<i>Chamaesyce glyptosperma</i>	Spurge	Euphorbiaceae
<i>Cirsium canescens</i>	Hoary Thistle	Compositae
<i>Conyza canadensis</i>	Horseweed	Compositae
<i>Epilobium paniculatum</i>	Willow Herb	Onagraceae
<i>Erigeron divergens</i>	Spreading Fleabane	Compositae
<i>Eriogonum annuum</i>	Annual Buckwheat	Polygonaceae
<i>Helianthus annuus</i>	Annual Sunflower	Compositae
<i>Iva xanthifolia</i>	Marsh Elder	Compositae
<i>Lactuca serriola</i>	Prickly Lettuce	Compositae
<i>Melilotus alba</i>	White Sweetclover	Leguminosae
<i>Melilotus officinalis</i>	Yellow Sweetclover	Leguminosae
<i>Polygonum aviculare</i>	Devil's Shoestrings	Polygonaceae
<i>Portulaca oleracea</i>	Purslane	Portulacaceae
<i>via reflexa</i>	Salvia	Labiatae
<i>.bena bracteata</i>	Creeping Charlie	Verbenaceae
<i>Veronica peregrina</i>	Speedwell	Scrophulariaceae
<i>Xanthium strumarium</i>	Cocklebur	Compositae
SEMI-SHRUBS OR HALF-SHRUBS		
<i>Artemisia frigida</i>	Fringed Sagewort	Compositae

Scientific Name	Common Name	Family Name
<i>Artemisia ludoviciana</i>	Louisiana Sagewort	Compositae
<i>Gutierrezia sarothrae</i>	Broom Snakeweed	Compositae
SHRUBS		
<i>Ceratoides lanata</i>	Winterfat	Chenopodiaceae
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	Compositae
<i>Rosa woodsii</i>	Woods Rose	Rosaceae
<i>Salix exigua</i>	Coyote Willow	Salicaceae
<i>Symphoricarpos occidentalis</i>	Western Snowberry	Caprifoliaceae
CACTI AND SUCCULENTS		
<i>Opuntia polyacantha</i>	Plains Prickly Pear	Cactaceae
<i>Populus sargentii</i>	Plains Cottonwood	Salicaceae
<i>Salix amygdaloides</i>	Peach-leaved Willow	Salicaceae
<i>Ulmus pumila</i>	Chinese Elm	Ulmaceae

Table 68.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
WEEDY FORB TYPE IN SECTION 36 AT THE ROCKY MOUNTAIN  
ARSENAL. BASED ON DATA FROM 12 SAMPLING LOCATIONS. 1986  
DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
<i>Agropyron smithii</i>	0.42	1.47	0 - 3	16.67	3.08	4.55	12
Sub-total	0.42	1.47					
WARM SEASON PERENNIAL GRASSES							
<i>Bouteloua gracilis</i>	1.08	3.82	0 - 13	8.33	1.54	5.36	10
Sub-total	1.08	3.82					
PERENNIAL FORBS							
<i>Ambrosia paillostachya</i>	2.17	7.65	0 - 12	50.00	9.23	16.88	4
<i>Asclepias speciosa</i>	0.08	0.29	0 - 1	8.33	1.54	1.93	19
<i>Cirsium arvense</i>	0.50	1.76	0 - 6	8.33	1.54	3.30	16
<i>Convolvulus arvensis</i>	0.58	2.06	0 - 7	8.33	1.54	3.60	15
<i>Kuhnia eupatorioides</i>	0.17	0.59	0 - 1	16.67	3.08	3.67	14
<i>Machaeranthera pinnatifida</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19
<i>Oenothera coronopifolia</i>	1.17	4.12	0 - 8	25.00	4.62	8.73	7
<i>Psoralea tenuiflora</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19
<i>Senecio spartioides</i>	0.17	0.59	0 - 2	8.33	1.54	2.13	18
<i>Sphaeralcea coccinea</i>	2.33	8.24	0 - 7	50.00	9.23	17.47	3
Sub-total	7.33	25.88					
ANNUAL AND BIENNIAL FORBS							
<i>Chamaesyce serpyllifolia</i>	0.17	0.59	0 - 1	16.67	3.08	3.67	14
<i>Chenopodium leptophyllum</i>	0.25	0.88	0 - 2	8.33	1.54	2.42	17
<i>Cirsium canescens</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19
<i>Cleome serrulata</i>	1.67	5.88	0 - 18	25.00	4.62	10.50	6
<i>Conyza canadensis</i>	0.33	1.18	0 - 2	16.67	3.08	4.25	13
<i>Croton texensis</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19

Table 68. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I.V.	Rank
<i>Descurainia richardsonii</i>	1.17	4.12	0 - 9	16.67	3.08	7.19	9
<i>Gaura parviflora</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19
<i>Helianthus annuus</i>	1.17	4.12	0 - 5	25.00	4.62	8.73	7
<i>Kochia iranica</i>	4.33	15.29	0 - 16	33.33	6.16	21.45	2
<i>Lactuca serriola</i>	6.33	22.35	0 - 49	33.33	6.16	28.51	1
<i>Machaeranthera canescens</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19
<i>Salsola iberica</i>	1.75	6.18	0 - 12	50.00	9.23	15.41	5
<i>Sisymbrium altissimum</i>	0.17	0.59	0 - 2	8.33	1.54	2.13	18
<i>Solanum triflorum</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19
<i>Verbena bracteata</i>	0.58	2.06	0 - 5	16.67	3.08	5.14	11
Sub-total	18.33	64.71					
SHRUBS							
<i>Eriogonum effusum</i>	1.08	3.82	0 - 7	25.00	4.62	8.44	8
Sub-total	1.08	3.82					
CACTI AND SUCCULENTS							
<i>Yucca glauca</i>	0.08	0.29	0 - 1	8.33	1.54	1.83	19
Sub-total	0.08	0.29					
SUM OF SPECIES COVER	28.33						
LITTER							
	40.92		24 - 56	100.00			
TOTAL VEGETATION							
LITTER/ROCK	28.83 +/-	14.96					
BARE SOIL	40.92 +/-	12.66					
TOTAL COVER	30.25 +/-	14.38					
	69.75 +/-	14.38					
Number of Species/sample	5.42						



Table 69.

PRODUCTION SUMMARY FOR THE WEEDY, FORB TYPE IN  
SECTION 36 AT THE ROCKY MOUNTAIN ARSENAL. BASED  
ON DATA FROM 12 SAMPLING LOCATIONS. 1986 DATA.  
+/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
<i>Agropyron smithii</i>	0.05	0.00 - 0.63	0.04
WARM SEASON PERENNIAL GRASSES			
<i>Bouteloua gracilis</i>	1.92	0.00 - 23.01	1.53
PERENNIAL FORBS			
<i>Ambrosia psilostachya</i>	24.14	0.00 - 151.61	19.32
<i>Convolvulus arvensis</i>	2.56	0.00 - 30.75	2.05
<i>Kuhnia eupatorioides</i>	0.00	0.00 - 0.01	0.00
<i>Oenothera coronopifolia</i>	2.50	0.00 - 22.09	2.00
<i>Physalis virginiana</i>	0.13	0.00 - 1.59	0.11
<i>Psoralea tenuiflora</i>	0.38	0.00 - 4.56	0.30
<i>Senecio tridenticulatus</i>	0.75	0.00 - 9.05	0.60
<i>Sphaeralcea coccinea</i>	15.32	0.00 - 49.18	12.27
<i>Tradescantia occidentalis</i>	0.00	0.00 - 0.01	0.00
Sub-total	45.79		36.66
ANNUAL AND BIENNIAL FORBS			
<i>Chamaesyce serpyllifolia</i>	0.00	0.00 - 0.01	0.00
<i>Chenopodium leptophyllum</i>	0.41	0.00 - 2.37	0.33
<i>Cleome serrulata</i>	11.86	0.00 - 78.92	9.49
<i>Conyza canadensis</i>	0.48	0.00 - 4.48	0.39
<i>Croton texensis</i>	0.39	0.00 - 4.68	0.31
<i>Cryptantha minima</i>	1.32	0.00 - 13.64	1.06
<i>Descurainia richardsonii</i>	0.11	0.00 - 1.29	0.09
<i>Helianthus annuus</i>	9.64	0.00 - 69.72	7.72
<i>Kochia iranica</i>	20.74	0.00 - 131.23	16.60
<i>Lactuca serriola</i>	29.98	0.00 - 213.52	24.00
<i>Machaeranthera canescens</i>	0.23	0.00 - 2.03	0.13
<i>Plantago patagonica</i>	0.79	0.00 - 9.44	0.63
<i>Salsola iberica</i>	0.92	0.00 - 8.46	0.74
<i>Solanum rostratum</i>	0.03	0.00 - 0.31	0.02
<i>Solanum triflorum</i>	0.26	0.00 - 3.05	0.20
<i>Verbena bracteata</i>	0.02	0.00 - 0.21	0.01
Sub-total	77.16		61.77
TOTAL PRODUCTION	124.93 +/- 79.84		

Table 70.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CHEATGRASS WEEDY FORB TYPE IN SECTION 36 AT THE ROCKY  
MOUNTAIN ARSENAL. BASED ON DATA FROM 7 SAMPLING LOCATIONS.  
1986 DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency	Relative Frequency (%)	I.V.	Rank
<b>COOL SEASON PERENNIAL GRASSES</b>							
<i>Aristida longiseta</i>	0.86	2.09	0 - 4	28.57	6.06	8.15	4
<i>Schedonnardus paniculatus</i>	0.14	0.35	0 - 1	14.29	3.03	3.38	11
Sub-total	1.00	2.44					
<b>ANNUAL GRASSES</b>							
<i>Bromus tectorum</i>	33.71	82.23	8 - 56	100.00	21.21	103.44	1
<i>Munroa squarrosa</i>	0.14	0.35	0 - 1	14.29	3.03	3.38	11
Sub-total	33.86	82.58					
<b>PERENNIAL FORBS</b>							
<i>Ambrosia psilostachya</i>	1.00	2.44	0 - 7	14.29	3.03	5.47	7
<i>Convolvulus arvensis</i>	0.43	1.05	0 - 1	14.29	3.03	4.08	9
<i>Heterotheca villosa</i>	0.14	0.35	0 - 1	14.29	3.03	3.38	11
<i>Kuhnia eupatorioides</i>	0.57	1.39	0 - 3	28.57	6.06	7.45	5
<i>Lygodesmia juncea</i>	0.14	0.35	0 - 1	14.29	3.03	3.38	11
<i>Physalis virginiana</i>	1.00	2.44	0 - 5	42.86	9.09	11.53	3
<i>Psoralea tenuiflora</i>	0.43	1.05	0 - 2	--28.57	6.06	7.11	6
<i>Senecio spartioides</i>	0.29	0.70	0 - 2	14.29	3.03	3.73	10
<i>Sphaeralcea coccinea</i>	0.57	1.39	0 - 2	57.14	12.12	13.51	2
<i>Thelesperma megapotamicum</i>	0.14	0.35	0 - 1	14.29	3.03	3.38	11
Sub-total	4.71	11.50					
<b>ANNUAL AND BIENNIAL FORBS</b>							
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	0.57	1.39	0 - 4	14.29	3.03	4.42	8
<i>Chamaesyce serpyllifolia</i>	0.14	0.35	0 - 1	14.29	3.03	3.38	11
<i>Verbena bracteata</i>	0.14	0.35	0 - 1	14.29	3.03	3.38	11
Sub-total	0.86	2.09					

Table 70.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
SHRUBS							
<i>Eriogonum effusum</i>	0.29	0.70	0 - 2	14.29	3.03	3.73	10
Sub-total	0.29	0.70					
CACTI AND SUCCULENTS							
<i>Yucca glauca</i>	0.29	0.70	0 - 2	14.29	3.03	3.73	10
Sub-total	0.29	0.70					
SUM OF SPECIES COVER	41.00						
LITTER	47.86		20 - 63	100.00			
TOTAL VEGETATION	41.00 +/-	14.45					
LITTER/ROCK	47.86 +/-	14.80					
BARE SOIL	11.14 +/-	18.74					
TOTAL COVER	88.86 +/-	18.74					
Number of Species/sample	4.71						

Table 71.

PRODUCTION SUMMARY FOR THE CHEATGRASS WEEDY FORB  
TYPE IN SECTION 36 AT THE ROCKY MOUNTAIN ARSENAL.  
BASED ON DATA FROM 7 SAMPLING LOCATIONS. 1986  
DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
<i>Aristida longiseta</i>	2.21	0.00 - 15.46	1.81
<i>Schedonnardus paniculatus</i>	0.08	0.00 - 0.59	0.07
Sub-total	2.29		1.88
INTRODUCED PERENNIAL GRASSES			
<i>Agropyron desertorum</i>	0.00	0.00 - 0.01	0.00
ANNUAL GRASSES			
<i>Bromus tectorum</i>	108.32	5.98 - 249.90	88.93
PERENNIAL FORBS			
<i>Ambrosia psilostachya</i>	0.38	0.00 - 2.63	0.31
<i>Gaura coccinea</i>	0.05	0.00 - 0.35	0.04
<i>Heterotheca villosa</i>	0.77	0.00 - 5.37	0.63
<i>Lygodesmia juncea</i>	0.27	0.00 - 1.89	0.22
<i>Oenothera coronopifolia</i>	0.43	0.00 - 3.04	0.36
<i>Psoralea tenuiflora</i>	4.26	0.00 - 29.79	3.49
<i>Senecio spartioides</i>	0.35	0.00 - 2.43	0.29
<i>Sphaeralcea coccinea</i>	0.25	0.00 - 1.71	0.20
Sub-total	6.75		5.54
ANNUAL AND BIENNIAL FORBS			
<i>Carduus nutans</i> ssp. <i>macrolepis</i>	0.29	0.00 - 2.02	0.24
<i>Descurainia richardsonii</i>	1.85	0.00 - 6.91	1.52
<i>Lappula redowskii</i>	0.01	0.00 - 0.10	0.01
<i>Machaeranthera canescens</i>	0.08	0.00 - 0.53	0.06
<i>Sisymbrium altissimum</i>	2.21	0.00 - 14.52	1.81
Sub-total	4.44		3.65
TOTAL PRODUCTION	121.80 +/- 60.26		

Table 72.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CHIEATGRASS/PERENNIAL GRASS TYPE IN SECTION 36 AT THE ROCKY  
MOUNTAIN ARSENAL. BASED ON DATA FROM 5 SAMPLING LOCATIONS.  
1963 DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron smithii	0.30	2.50	0 - 4	20.00	3.13	5.63	8
Aristida longiseta	1.80	5.00	0 - 4	80.00	12.50	17.50	2
Sub-total	2.40	7.50					
WARM SEASON PERENNIAL GRASSES							
Sporobolus cryptandrus	0.40	1.25	0 - 1	40.00	6.25	7.50	7
Sub-total	0.40	1.25					
ANNUAL GRASSES							
Bromus tectorum	21.00	65.63	12 - 32	100.00	15.63	31.25	1
Sub-total	21.00	65.63					
PERENNIAL FORDS							
Ambrosia psillostachya	1.00	3.13	0 - 2	60.00	9.38	12.50	4
Convolvulus arvensis	0.80	2.50	0 - 3	40.00	6.25	8.75	5
Kuhnia eupatorioides	0.60	1.88	0 - 3	20.00	3.13	5.00	9
Oenothera coronopifolia	2.80	8.75	0 - 10	40.00	6.25	15.00	3
Physalis virginiana	0.40	1.25	0 - 1	40.00	6.25	7.50	7
Psoralea tenuiflora	1.00	3.13	0 - 2	60.00	9.38	12.50	4
Sphaeralcea coccinea	0.40	1.25	0 - 1	40.00	6.25	7.50	7
Sub-total	7.00	21.88					
ANNUAL AND BIENNIAL FORBS							
Chamaesyce serpyllifolia	0.20	0.63	0 - 1	20.00	3.13	3.75	10
Cryptantha minima	0.20	0.63	0 - 1	20.00	3.13	3.75	10
Lactuca serriola	0.20	0.63	0 - 1	20.00	3.13	3.75	10
Sub-total	0.60	1.88					

Table 72.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
SEMI-SHRUBS OR HALF-SHRUBS							
Gutierrezia sarothrae	0.60	1.88	0 - 2	40.00	6.25	8.13	8
Sub-total	0.60	1.88					
SUM OF SPECIES COVER	32.00						
LITTER	66.40		60 - 72	100.00			
TOTAL VEGETATION	32.00 +/-	6.40					
LITTER/ROCK	66.40 +/-	4.77					
BARE SOIL	2.60 +/-	2.88					
TOTAL COVER	97.40 +/-	2.88					
Number of Species/sample	6.40						

Table 73.

PRODUCTION SUMMARY FOR CHEATGRASS/PERENNIAL GRASS  
TYPE IN SECTION 36 AT THE ROCKY MOUNTAIN ARSENAL.  
BASED ON DATA FROM 5 SAMPLING LOCATIONS. 1986  
DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
<i>Aristida longiseta</i>	4.31	0.00 - 18.94	7.52
ANNUAL GRASSES			
<i>Bromus tectorum</i>	24.53	7.34 - 38.99	42.81
PERENNIAL FORBS			
<i>Ambrosia psilostachya</i>	1.56	0.00 - 6.49	2.73
<i>Oenothera coronopifolia</i>	13.94	0.00 - 31.18	24.34
<i>Physalis virginiana</i>	5.42	0.00 - 24.21	9.45
<i>Psoralea tenuiflora</i>	1.26	0.00 - 6.04	2.21
<i>Sphaeralcea coccinea</i>	2.38	0.00 - 7.81	4.16
Sub-total	24.57		42.88
ANNUAL AND BIENNIAL FORBS			
<i>Descurainia richardsonii</i>	0.76	0.00 - 3.81	1.33
<i>Lactuca serriola</i>	0.21	0.00 - 1.07	0.37
Sub-total	0.98		1.70
SEMI-SHRUBS OR HALF-SHRUBS			
<i>Gutierrezia sarothrae</i>	2.92	0.00 - 14.59	5.09
TOTAL PRODUCTION	57.30 +/- 16.37		

Table 7%.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
WEEDY FORB TYPE IN SECTION 26 AT THE ROCKY MOUNTAIN  
ARSENAL. BASED ON DATA FROM 8 SAMPLING LOCATIONS. 1985  
DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean. Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
WARM SEASON PERENNIAL GRASSES							
<i>Sporobolus cryptandrus</i>	0.75	1.74	0 - 6	12.50	2.78	4.52	9
Sub-total	0.75	1.74					
ANNUAL GRASSES							
<i>Bromus tectorum</i>	16.75	38.84	0 - 51	75.00	16.67	55.51	1
Sub-total	16.75	38.84					
PERENNIAL FORBS							
<i>Ambrosia psilostachya</i>	0.88	2.03	0 - 7	12.50	2.78	4.81	8
<i>Physalis virginiana</i>	1.00	2.32	0 - 5	25.00	5.56	7.87	6
<i>Sphaeralcea coccinea</i>	1.63	3.77	0 - 13	12.50	2.78	6.55	7
Sub-total	3.50	8.12					
ANNUAL AND BIENNIAL FORBS							
<i>Amaranthus graecizans</i>	0.63	1.45	0 - 5	12.50	2.78	4.23	10
<i>Ambrosia acanthicarpa</i>	0.13	0.29	0 - 1	12.50	2.78	3.07	13
<i>Descurainia richardsonii</i>	6.00	13.91	0 - 19	37.50	8.33	22.25	3
<i>Hellianthus annuus</i>	0.25	0.58	0 - 2	12.50	2.78	3.36	12
<i>Hellianthus petiolaris</i>	0.63	1.45	0 - 5	12.50	2.78	4.23	10
<i>Kochia iranica</i>	5.75	13.33	0 - 36	37.50	8.33	21.67	4
<i>Lactuca serriola</i>	1.25	2.90	0 - 4	75.00	16.67	19.57	5
<i>Salsola iberica</i>	0.25	0.58	0 - 2	12.50	2.78	3.36	12
<i>Sisymbrium altissimum</i>	6.38	14.78	0 - 15	62.50	13.89	28.67	2
<i>Solanum triflorum</i>	0.38	0.87	0 - 3	12.50	2.78	3.65	11
<i>Verbesina encelioides</i>	0.13	0.29	0 - 1	12.50	2.78	3.07	13
Sub-total	21.75	50.43					



Table 74.(cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
CACTI AND SUCCULENTS							
Yucca glauca	0.38	0.87	0 - 3	12.50	2.78	3.85	11
Sub-total	0.38	0.87					
SUM OF SPECIES COVER	43.13						
LITTER	43.25		14 - 62	100.00			
TOTAL VEGETATION	43.38 +/-	11.62					
LITTER/ROCK	43.25 +/-	15.15					
BARE SOIL	13.38 +/-	18.07					
TOTAL COVER	86.63 +/-	18.07					
Number of Species/sample	4.50						

Table 75.

PRODUCTION SUMMARY FOR THE WEEDY FORB TYPE IN  
SECTION 26 AT THE ROCKY MOUNTAIN ARSENAL. BASED  
ON DATA FROM 8 SAMPLING LOCATIONS. 1986 DATA.  
+/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
WARM SEASON PERENNIAL GRASSES			
Sporobolus cryptandrus	5.26	0.00 - 42.05	3.24
ANNUAL GRASSES			
Bromus tectorum	24.04	0.00 - 97.23	14.82
PERENNIAL FORBS			
Ambrosia psilostachya	23.96	0.00 - 190.67	14.77
Gaura coccinea	0.49	0.00 - 3.91	0.30
Oenothera coronopifolia	2.69	0.00 - 21.54	1.66
Physalis virginiana	1.52	0.00 - 12.15	0.94
Psoralea tenuiflora	0.10	0.00 - 0.84	0.06
Sphaeralcea coccinea	2.35	0.00 - 12.13	1.45
Sub-total	31.11		19.17
ANNUAL AND BIENNIAL FORBS			
Amaranthus albus	1.24	0.00 - 9.89	0.76
Chenopodium leptophyllum	0.01	0.00 - 0.05	0.00
Conyza canadensis	1.97	0.00 - 14.80	1.22
Cryptantha minima	0.66	0.00 - 5.31	0.41
Descurainia richardsonii	14.14	0.00 - 47.67	8.71
Helianthus petiolaris	0.64	0.00 - 5.14	0.40
Kochia iranica	67.33	0.00 - 286.13	41.50
Lactuca serriola	13.05	0.00 - 27.43	8.05
Oenothera albicaulis	0.31	0.00 - 2.44	0.19
Salsola iberica	0.06	0.00 - 0.48	0.04
Sisymbrium altissimum	2.43	0.00 - 13.41	1.49
Sub-total	101.83		62.77
TOTAL PRODUCTION	182.36	+/- 93.33	

Table 76.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CHEATGRASS WEEDY FORB TYPE IN SECTION 26 AT THE ROCKY  
MOUNTAIN ARSENAL.. BASED ON DATA FROM 5 SAMPLING LOCATIONS.  
1986 DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron smithii	0.60	1.20	0 - 3	20.00	4.55	5.75	6
Sub-total	0.80	1.20					
WARM SEASON PERENNIAL GRASSES							
Sporobolus cryptandrus	2.80	5.60	0 - 14	20.00	4.55	10.15	4
Sub-total	2.80	5.60					
ANNUAL GRASSES							
Bromus tectorum	37.20	74.40	1 - 58	100.00	22.73	97.13	1
Sub-total	37.20	74.40					
PERENNIAL FORBS							
Convolvulus arvensis	0.40	0.80	0 - 2	20.00	4.55	5.35	7
Lygodesmia juncea	0.40	0.80	0 - 2	20.00	4.55	5.35	7
Physalis virginiana	1.80	3.60	0 - 7	40.00	9.09	12.69	3
Sub-total	2.60	5.20					
ANNUAL AND BIENNIAL FORBS							
Carduus nutans ssp. macrolepis	0.40	0.80	0 - 2	20.00	4.55	5.35	7
Descurainia richardsonii	0.40	0.80	0 - 2	20.00	4.55	5.35	7
Gaura parviflora	0.40	0.80	0 - 1	40.00	9.09	9.89	5
Helianthus annuus	0.40	0.80	0 - 2	20.00	4.55	5.35	7
Lactuca serriola	4.60	9.20	0 - 12	60.00	13.64	22.84	2
Salsola iberica	0.20	0.40	0 - 1	20.00	4.55	4.95	8
Sisymbrium altissimum	0.20	0.40	0 - 1	20.00	4.55	4.95	8
Sub-total	6.80	13.20					

Table 76. (cont'd).

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
CACTI AND SUCCULENTS							
Yucca glauca	0.20	0.40	0 - 1	20.00	4.55	4.95	8
Sub-total	0.20	0.40					
SUM OF SPECIES COVER	50.00						
LITTER	33.20		29 - 47	100.00			
TOTAL VEGETATION	50.40 +/-	18.89					
LITTER/ROCK	38.40 +/-	7.27					
BARE SOIL	11.20 +/-	23.40					
TOTAL COVER	88.80 +/-	23.40					
Number of Species/sample	4.40						

Table 77.

PRODUCTION SUMMARY FOR THE CHEATGRASS WEEDY FORB  
TYPE IN SECTION 26 AT THE ROCKY MOUNTAIN ARSENAL.  
BASED ON DATA FROM 5 SAMPLING LOCATIONS. 1986  
DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	0.46	0.00 - 2.32	0.24
WARM SEASON PERENNIAL GRASSES			
Sporobolus cryptandrus	6.67	0.00 - 33.34	3.46
ANNUAL GRASSES			
Bromus tectorum	147.51	0.00 - 410.52	76.57
PERENNIAL FORBS			
Cirsium arvense	9.34	0.00 - 48.69	4.85
Physalis virginiana	2.94	0.00 - 14.71	1.53
Sphaeralcea coccinea	3.07	0.00 - 15.36	1.59
Sub-total	15.35		7.97
ANNUAL AND BIENNIAL FORBS			
Helianthus petiolaris	5.56	0.00 - 27.79	2.89
Kochia iranica	0.07	0.00 - 0.35	0.04
Lactuca serriola	8.92	0.00 - 31.14	4.63
Salsola iberica	0.09	0.00 - 0.47	0.05
Sisymbrium altissimum	8.00	0.00 - 36.70	4.15
Sub-total	22.64		11.75
TOTAL PRODUCTION	192.63	+/-160.96	

Table 78.

COVER; FREQUENCY AND IMPORTANCE VALUE SUMMARY FOR THE  
CHEATGRASS/PERENNIAL GRASS TYPE IN SECTION 26 AT THE ROCKY  
MOUNTAIN ARSENAL. BASED ON DATA FROM 3 SAMPLING LOCATIONS.  
1986 DATA. +/- VALUES EQUAL THE STANDARD DEVIATION.

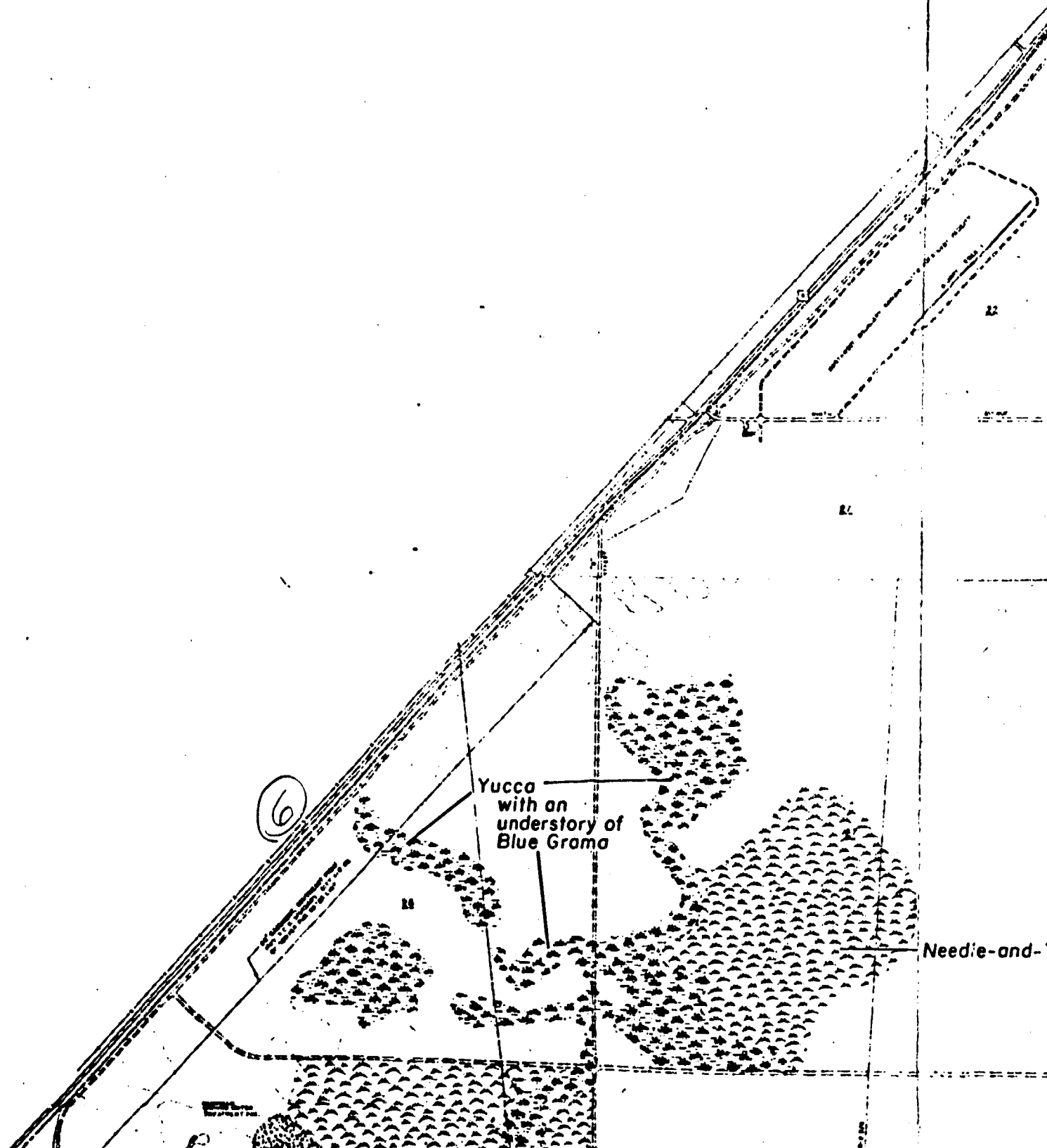
Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	I.V.	Rank
<b>WARM SEASON PERENNIAL GRASSES</b>							
<i>Sporobolus cryptandrus</i>	9.33	17.18	0 - 21	66.67	20.00	37.18	2
Sub-total	9.33	17.18					
<b>ANNUAL GRASSES</b>							
<i>Bromus tectorum</i>	42.67	78.53	22 - 63	100.00	30.00	108.53	1
Sub-total	42.67	78.53					
<b>PERENNIAL FORBS</b>							
<i>Cirsium arvense</i>	1.00	1.84	0 - 3	33.33	10.00	11.84	3
<i>Convolvulus arvensis</i>	0.33	0.61	0 - 1	33.33	10.00	10.61	4
<i>Lygodesmia juncea</i>	0.33	0.61	0 - 1	33.33	10.00	10.61	4
<i>Physalis virginiana</i>	0.33	0.61	0 - 1	33.33	10.00	10.61	4
Sub-total	2.00	3.68					
<b>ANNUAL AND BIENNIAL FORBS</b>							
<i>Carduus nutans ssp. macrolepis</i>	0.33	0.61	0 - 1	33.33	10.00	10.61	4
Sub-total	0.33	0.61					
<b>SUM OF SPECIES COVER</b>							
	54.33						
<b>LITTER</b>							
	45.00		33 - 53	100.00			
<b>TOTAL VEGETATION</b>							
	54.33 +/-	11.37					
<b>LITTER/ROCK</b>							
	45.00 +/-	10.58					
<b>BARE SOIL</b>							
	0.67 +/-	1.15					
<b>TOTAL COVER</b>							
	99.33 +/-	1.15					
Number of Species/sample	3.33						

Table 79.

PRODUCTION SUMMARY FOR THE CHEATGRASS/PERENNIAL  
GRASS TYPE IN SECTION 26 AT THE ROCKY MOUNTAIN  
ARSENAL. BASED ON DATA FROM 3 SAMPLING LOCATIONS.  
1986 DATA. +/- VALUES EQUAL THE STANDARD  
DEVIATION.

Species	Mean g/sq.m	Range of Production Values	Percent of Total Production
COOL SEASON PERENNIAL GRASSES			
Agropyron smithii	44.89	0.00 -134.67	19.52
WARM SEASON PERENNIAL GRASSES			
Sporobolus cryptandrus	13.72	0.00 - 24.85	5.97
ANNUAL GRASSES			
Bromus tectorum	166.59	9.21 -369.57	72.45
PERENNIAL FORBS			
Lygodesmia juncea	4.26	0.00 - 11.30	1.85
ANNUAL AND BIENNIAL FORBS			
Amaranthus albus	0.07	0.00 - 0.20	0.03
Lactuca serriola	0.41	0.00 - 1.23	0.18
Sub-total	0.48		0.21
TOTAL PRODUCTION	229.94	+/-131.01	

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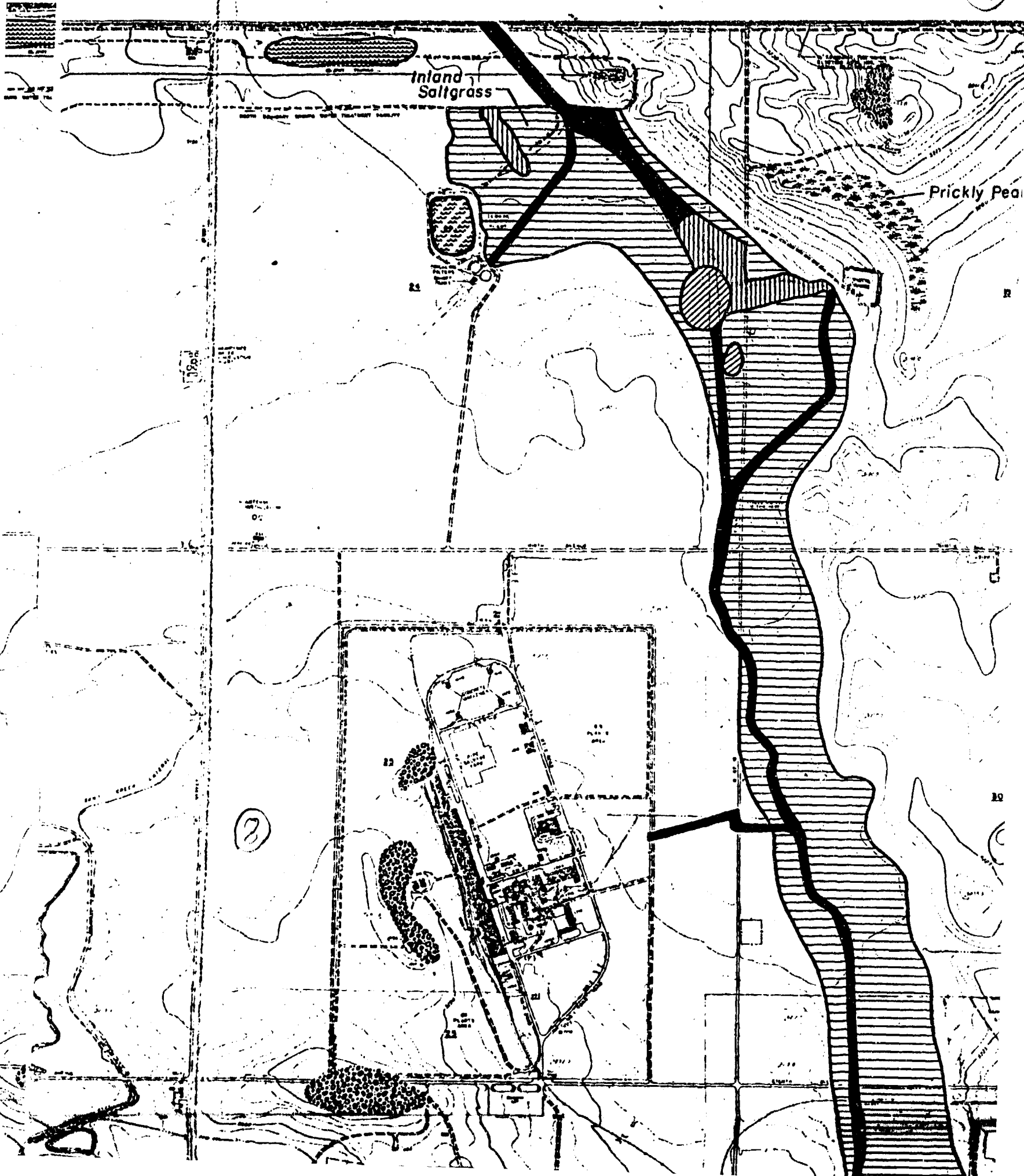
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## Needle-and-Thread

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(4)



Prickly Pear Cactus

20

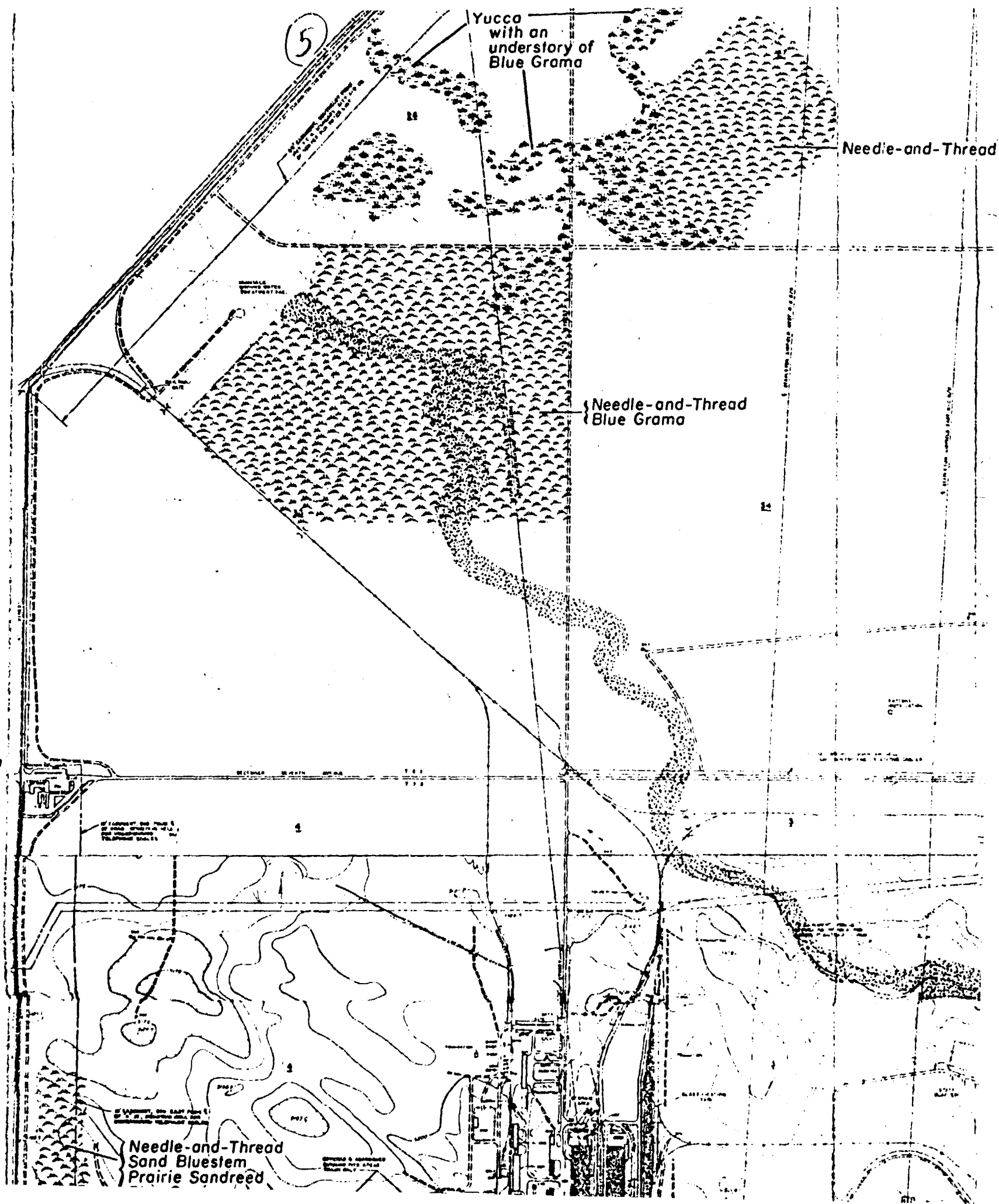
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(10)

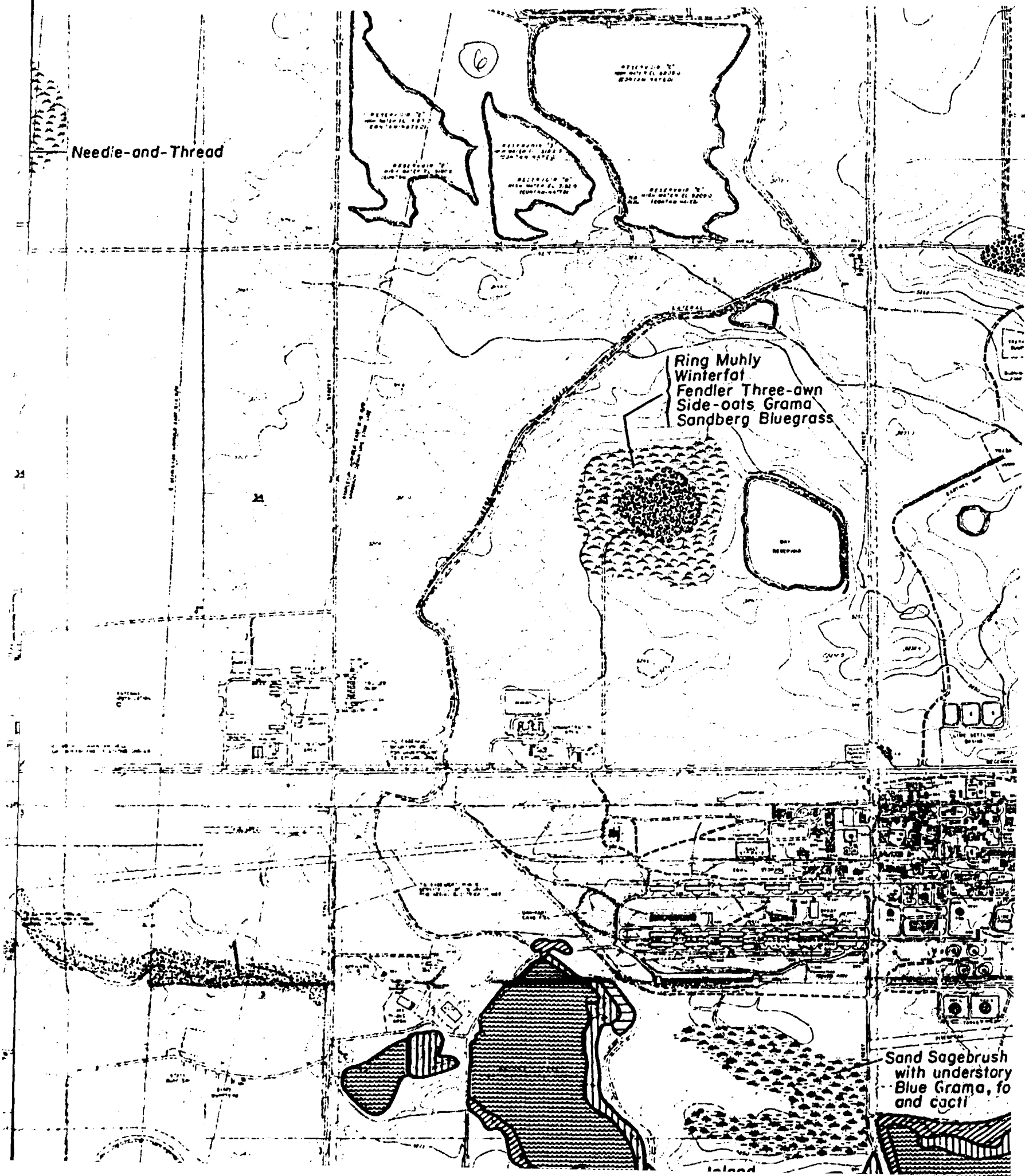
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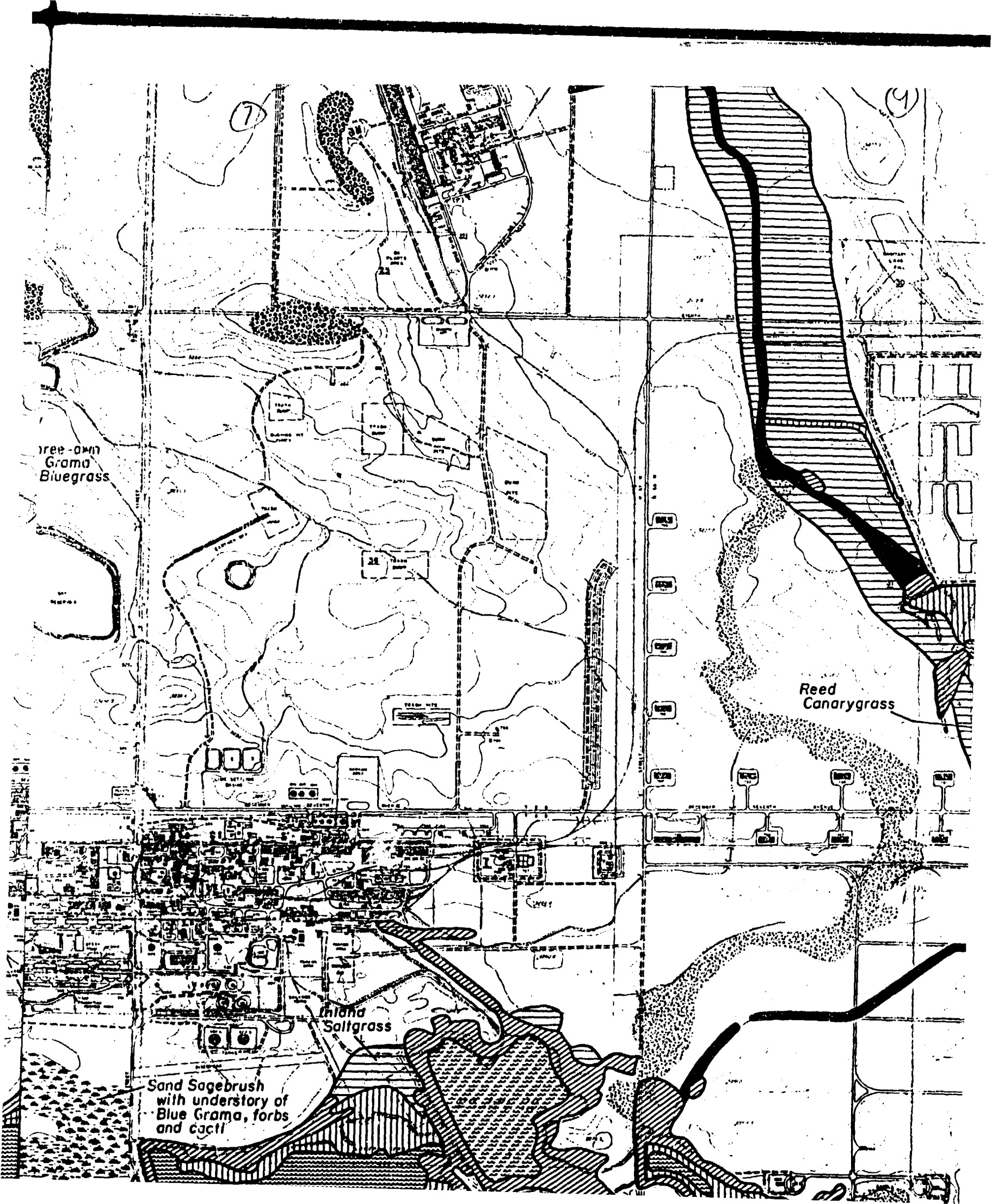


Needle-and-Thread

Ring Muhly  
Winterfat  
Fendler Three-awn  
Side-oats Grama  
Sandberg Bluegrass

Sand Sagebrush  
with understory  
Blue Grama, fo  
and cacti



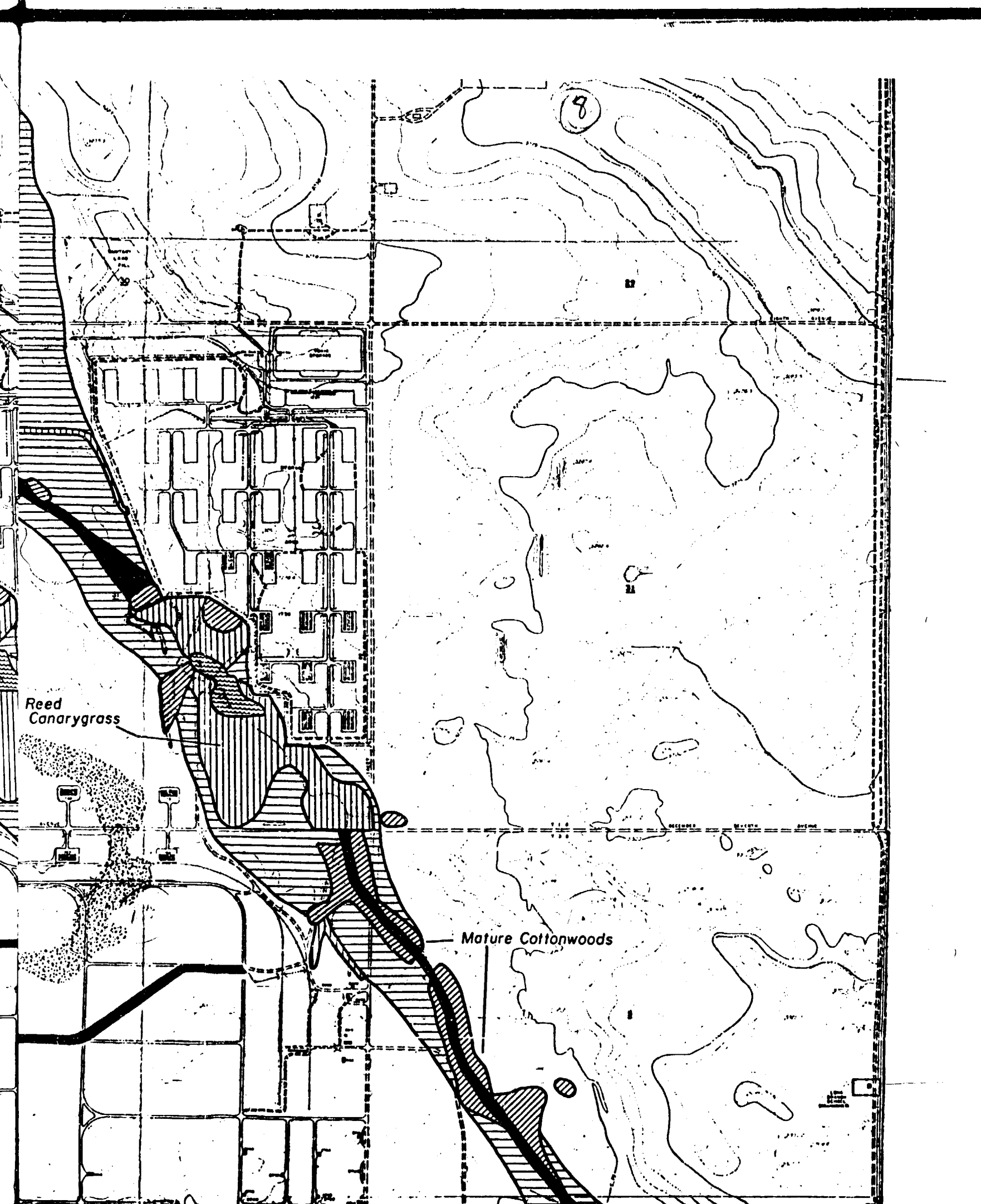


Tree-dominant  
Gramma  
Bluegrass

Reed  
Canarygrass

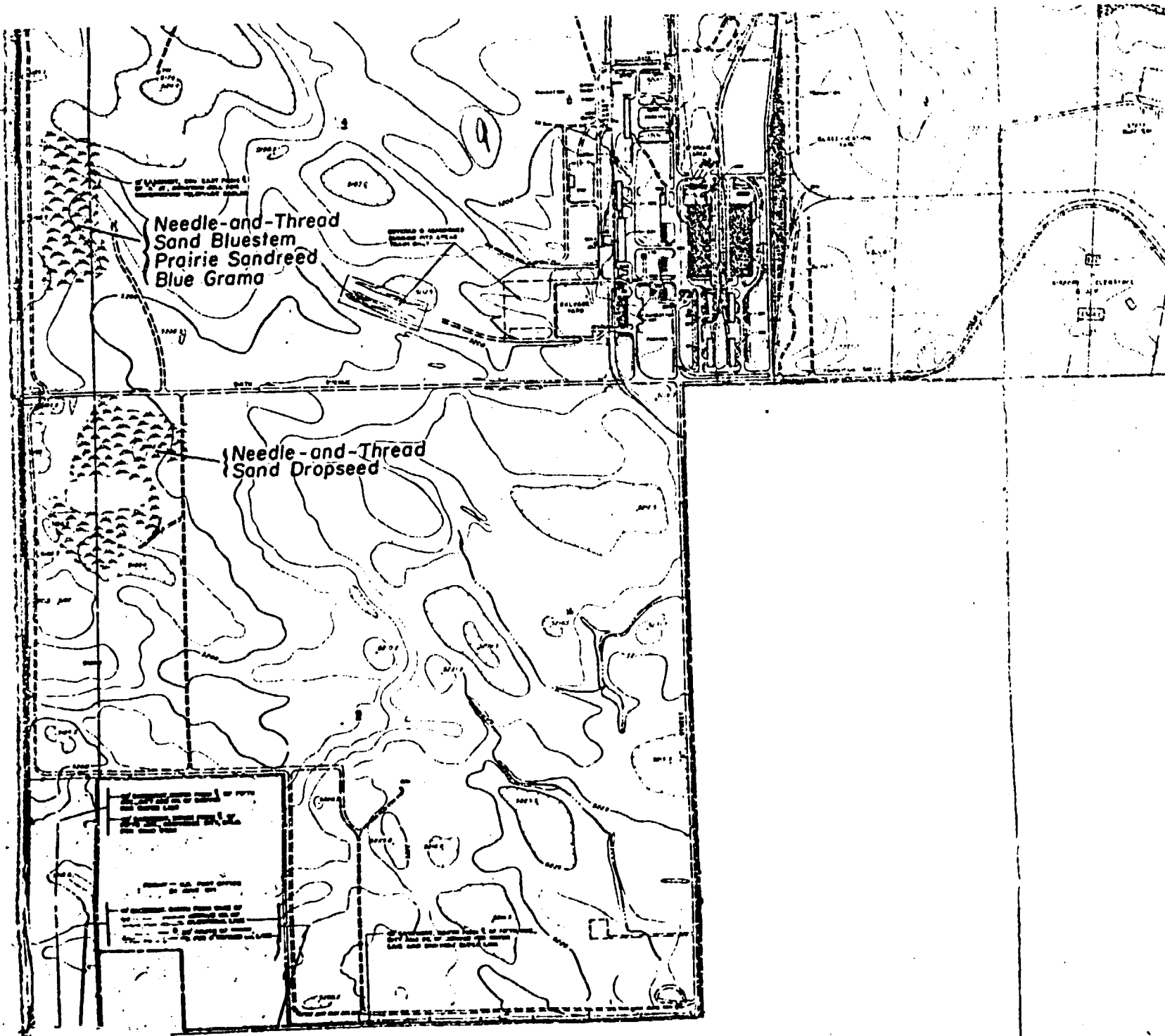
Shrubland  
Saltgrass

Sand Sagebrush  
with understory of  
Blue Grama, forbs  
and cacti







Reed  
Canarygrass

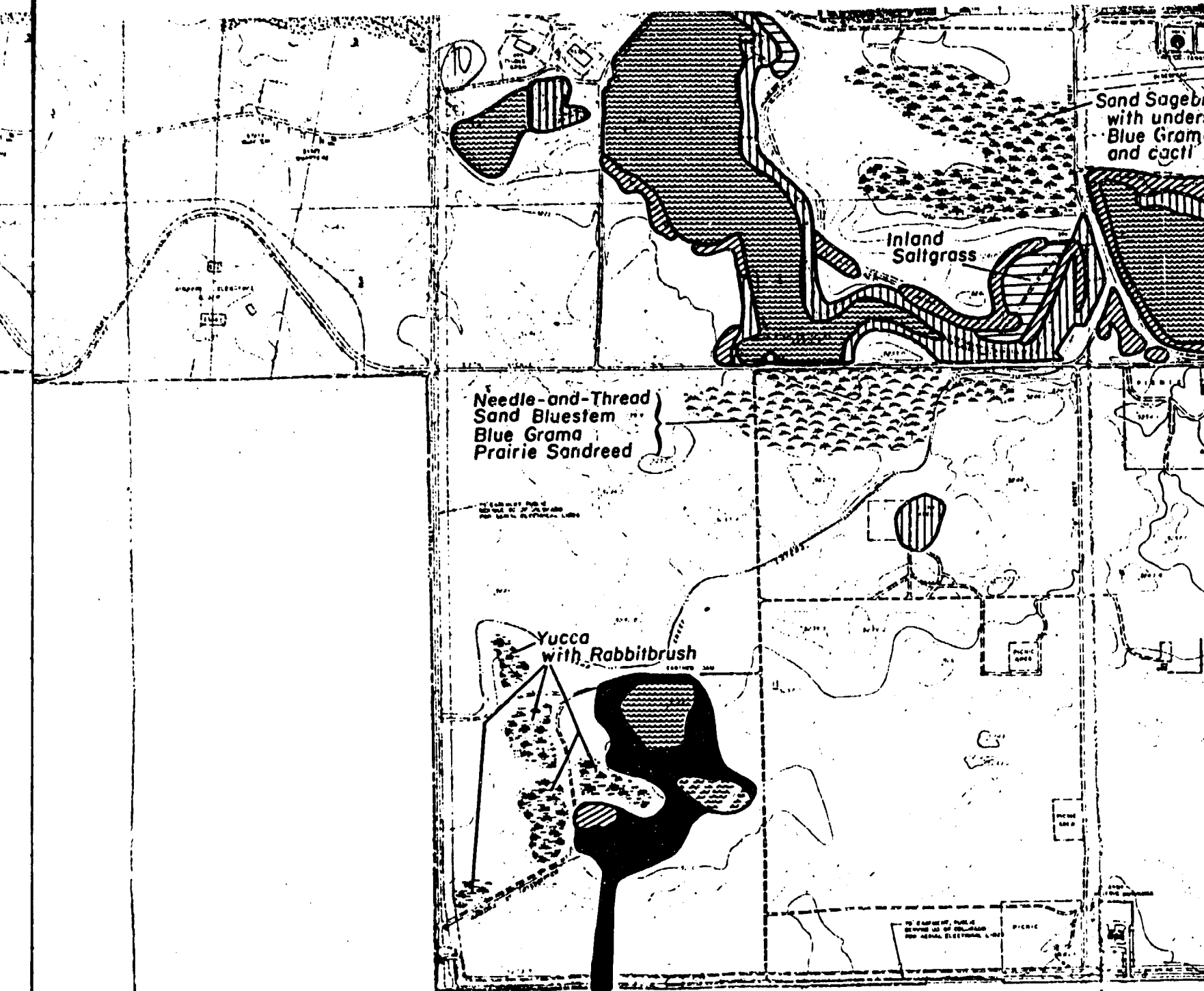
Mature Cottonwoods



# **WETLAND AREAS** (see map for additional species information)

-  Channel Vegetation
-  Cottonwood / Willow Stands
-  Marshes
-  Bottomland Meadows





# REMNPANT VEGETATION AREAS (see map for additional species information)



Grasslands



Succulents/Shrublands

## REMNPANT



Gr



S



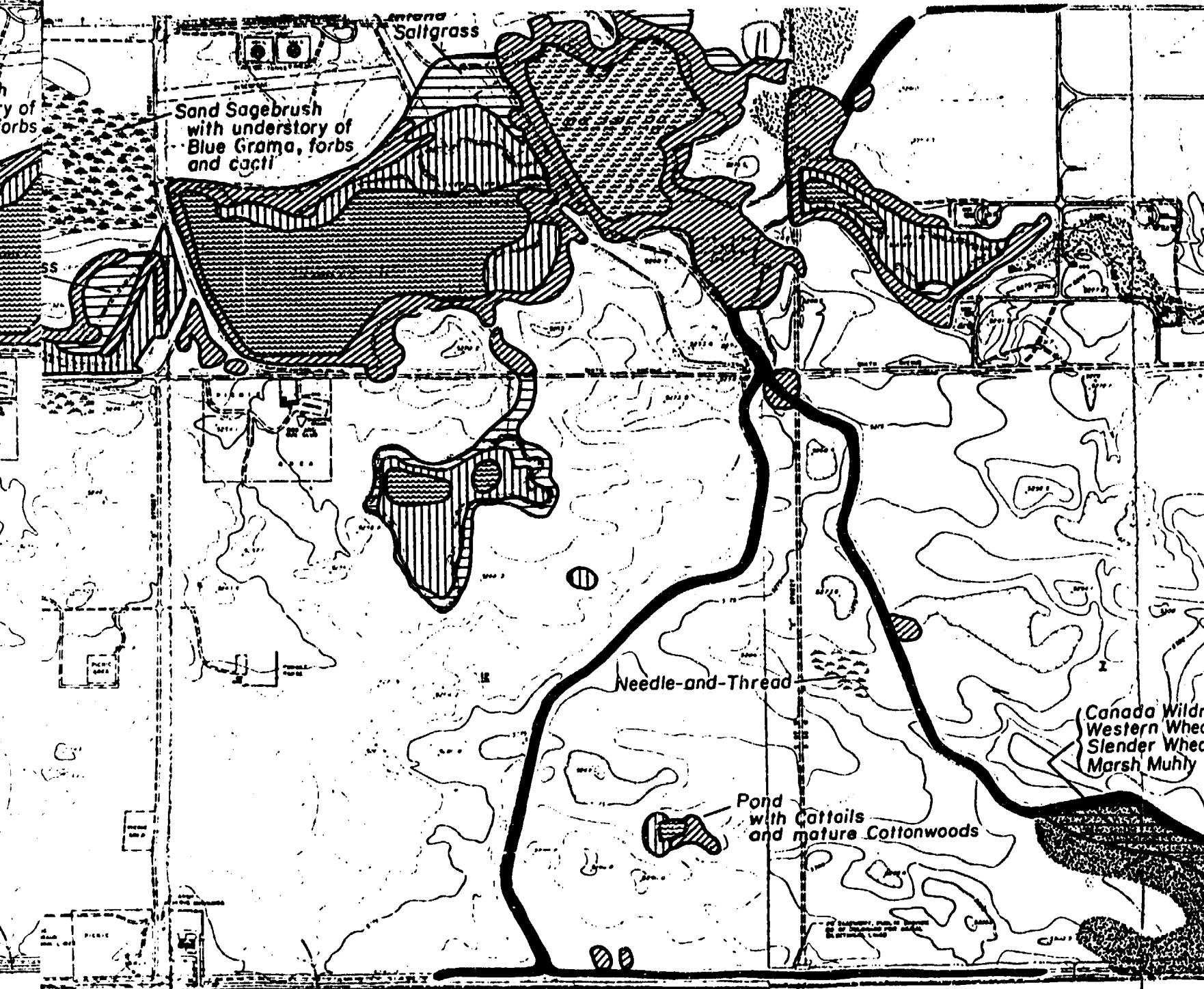
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species information)




tation

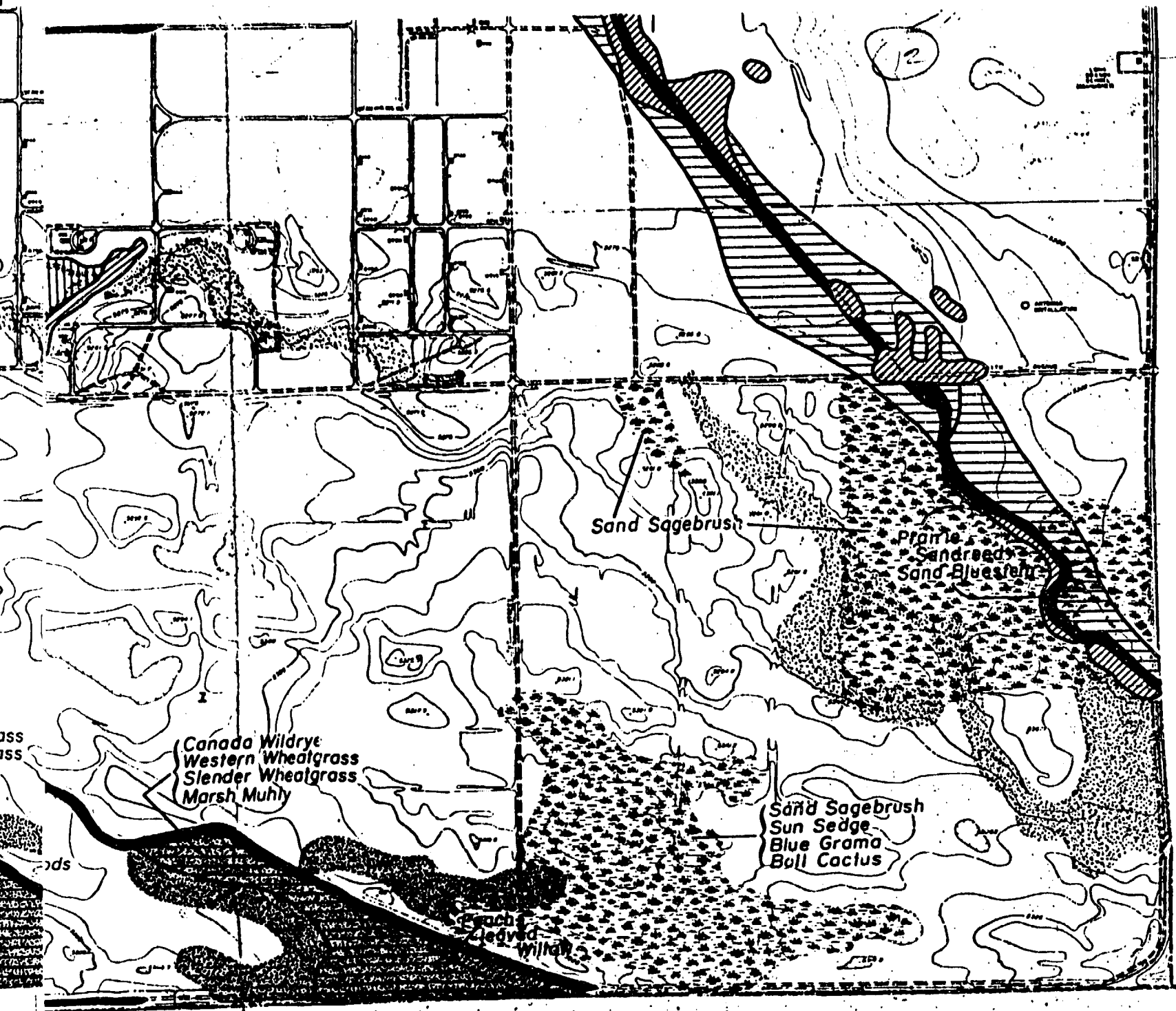
Willow Stands

eadows



## REMNANT & UNIQUE SOIL AREAS

-  Gravels - Ancient Alluvial Terrace Remnants
-  Swales - Loamy Alluvial Soils
-  Wet Soils - Subirrigated Soils



# Rocky Mountain Arsenal

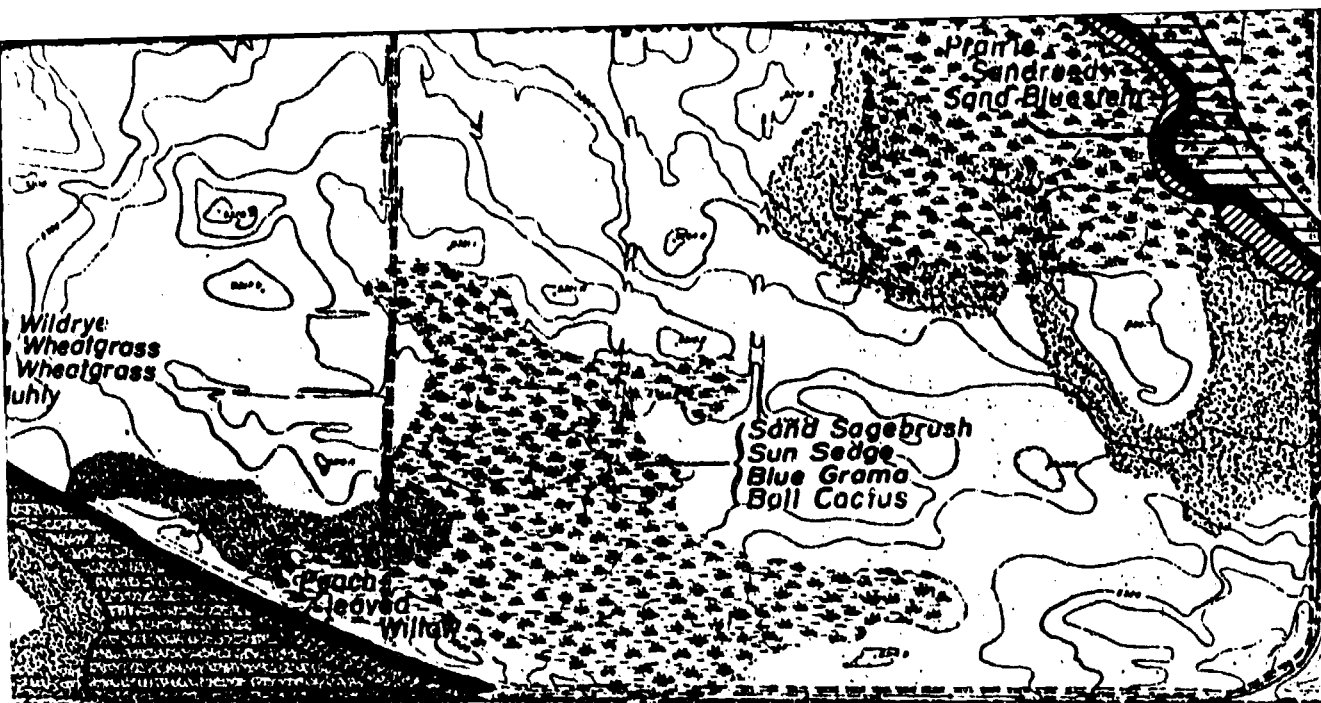
## NATURAL RESOURCE AREAS of SPECIAL INTEREST

App'd. By:

Scale: 1" = 1000'

Date: 11/88

MORRISON-KNUDSEN ENGINEERS, INC.



# Rocky Mountain Arsenal

## <sup>20</sup> NATURAL RESOURCE AREAS of SPECIAL INTEREST

App'd. By:

Scale: 1" = 1000'

Date: 11/88



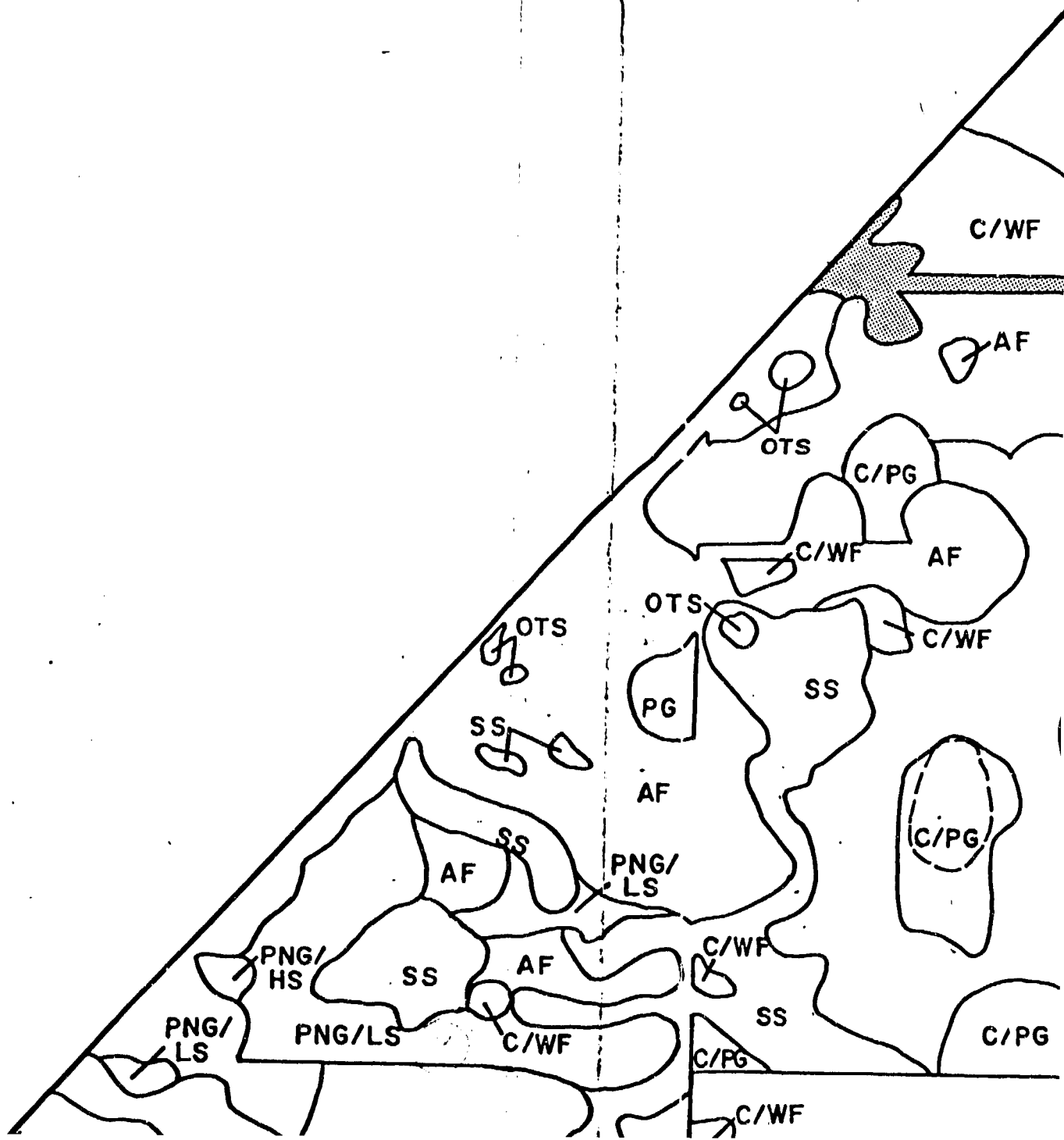
**MORRISON-KNUDSEN ENGINEERS, INC.**  
A MORRISON KNUDSEN COMPANY

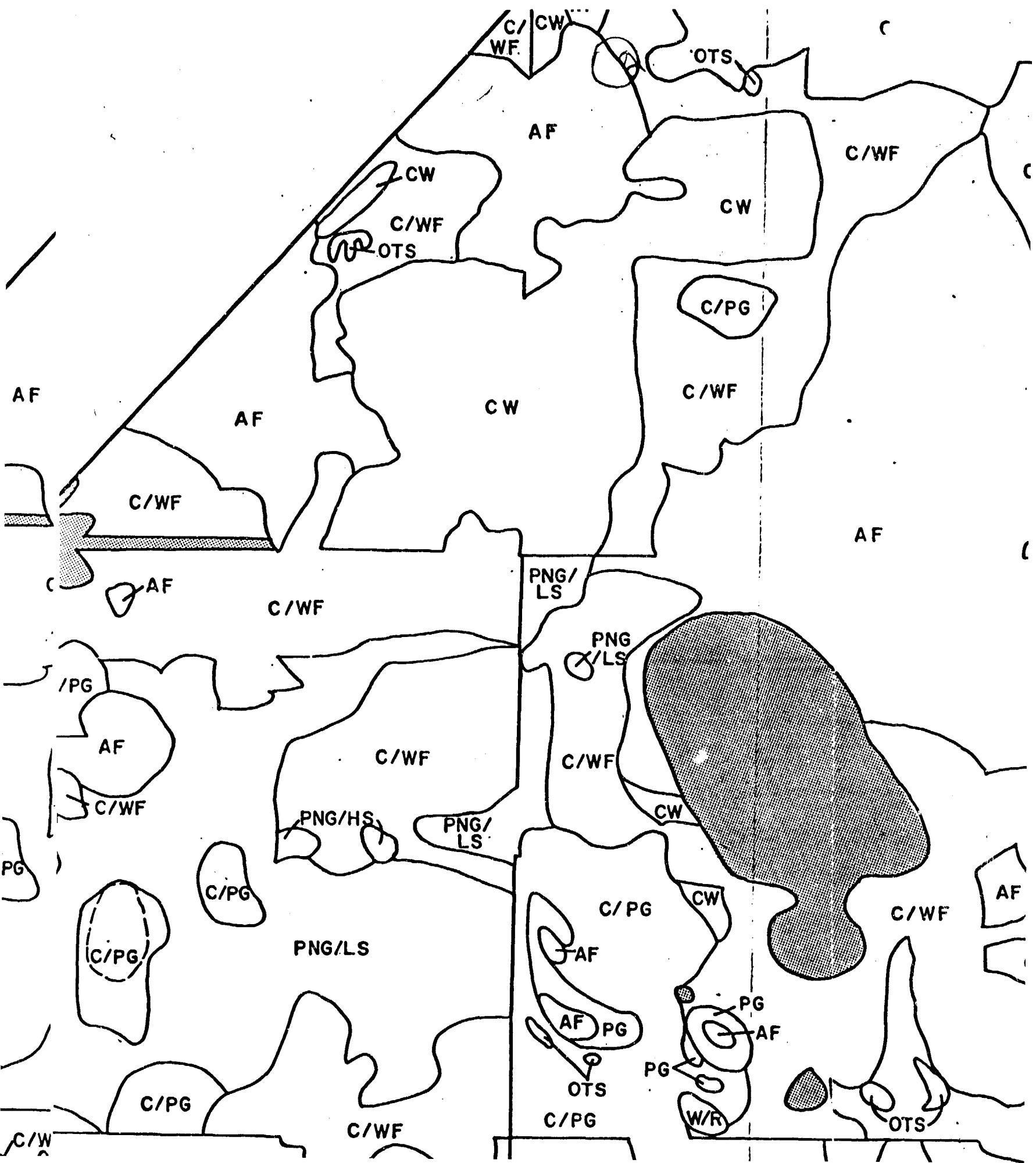
1700 Broadway, Suite 1600  
Denver, Colorado 80290

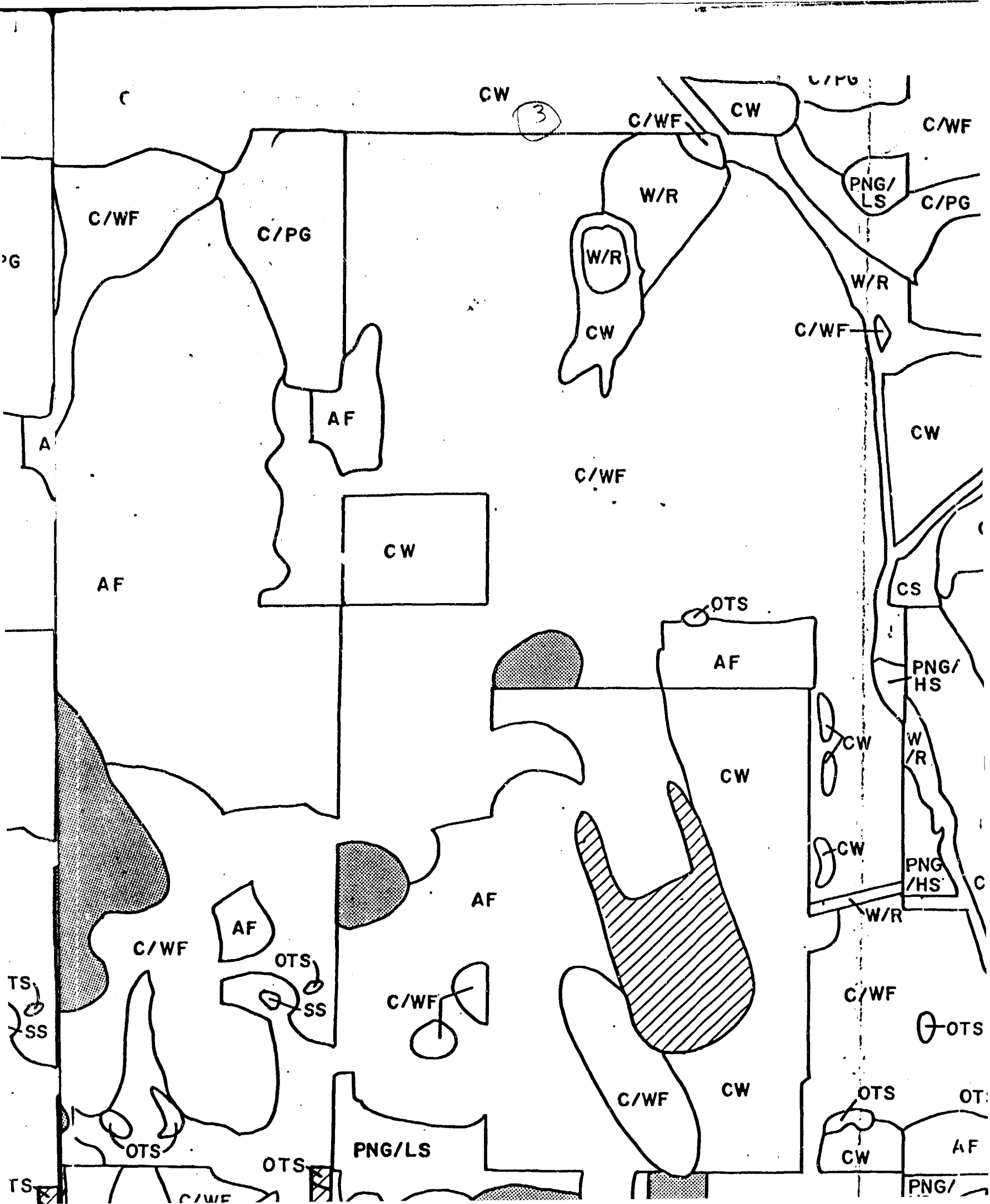
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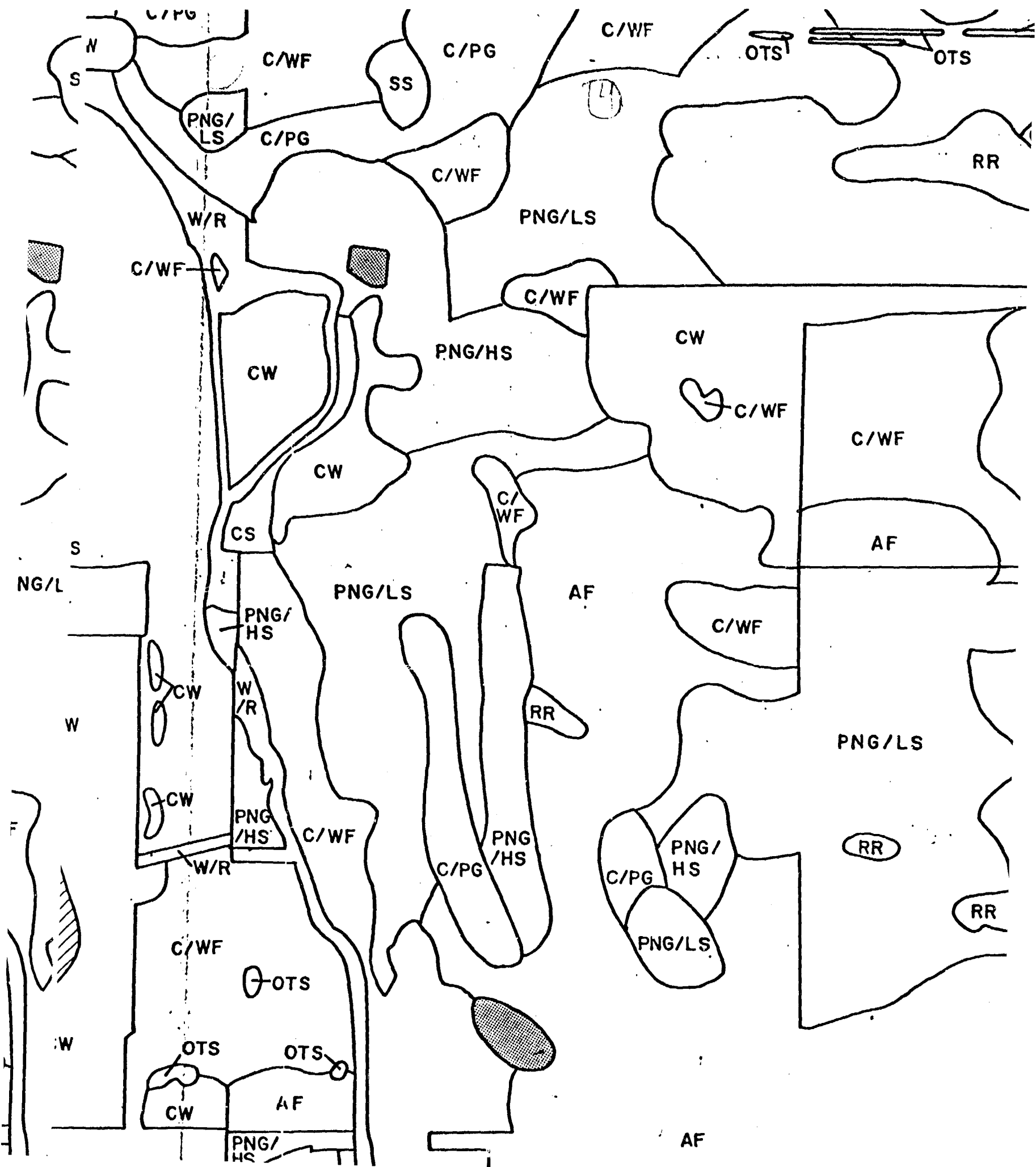
ORIGINAL

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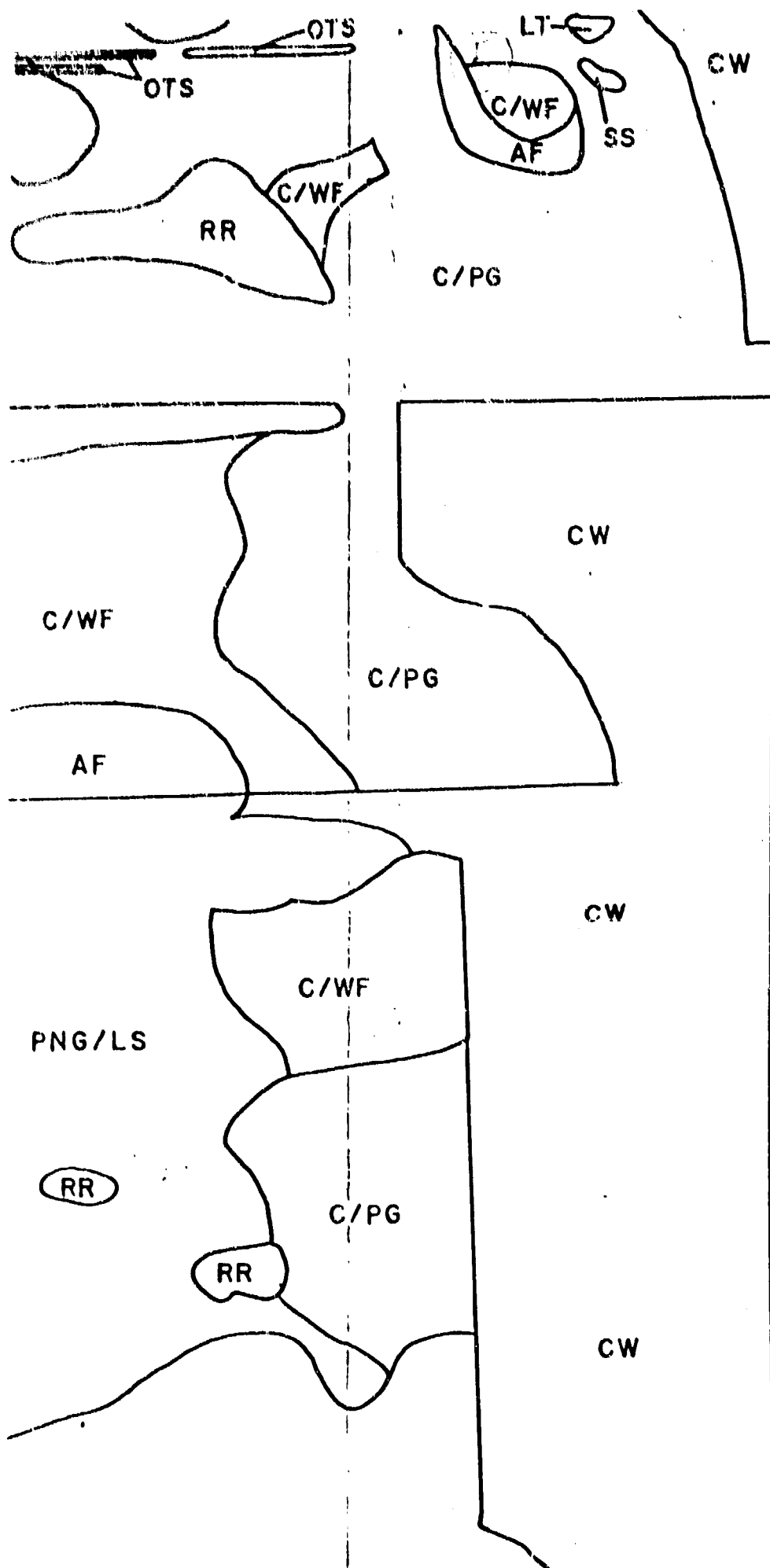





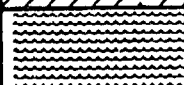






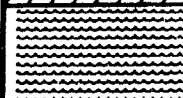





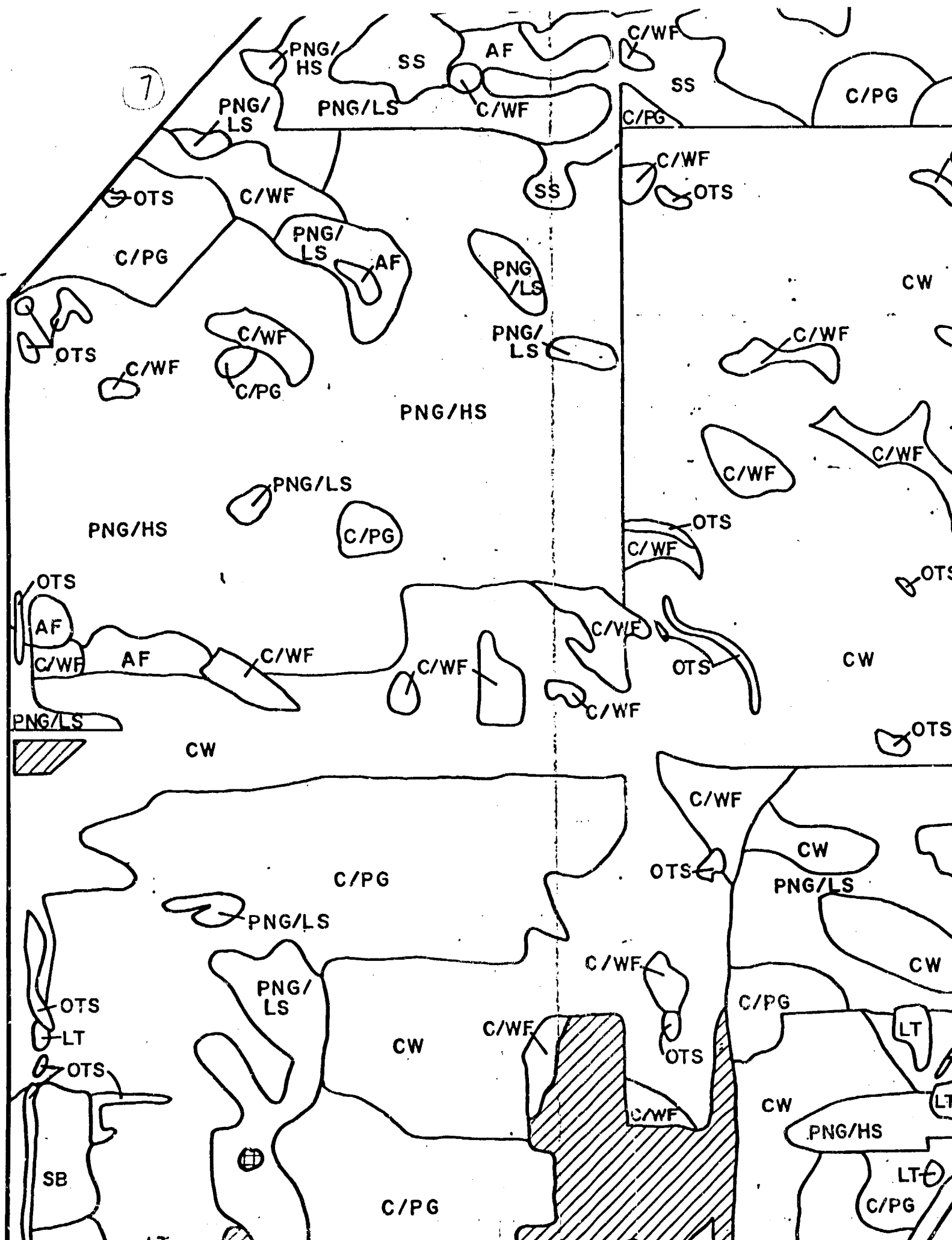
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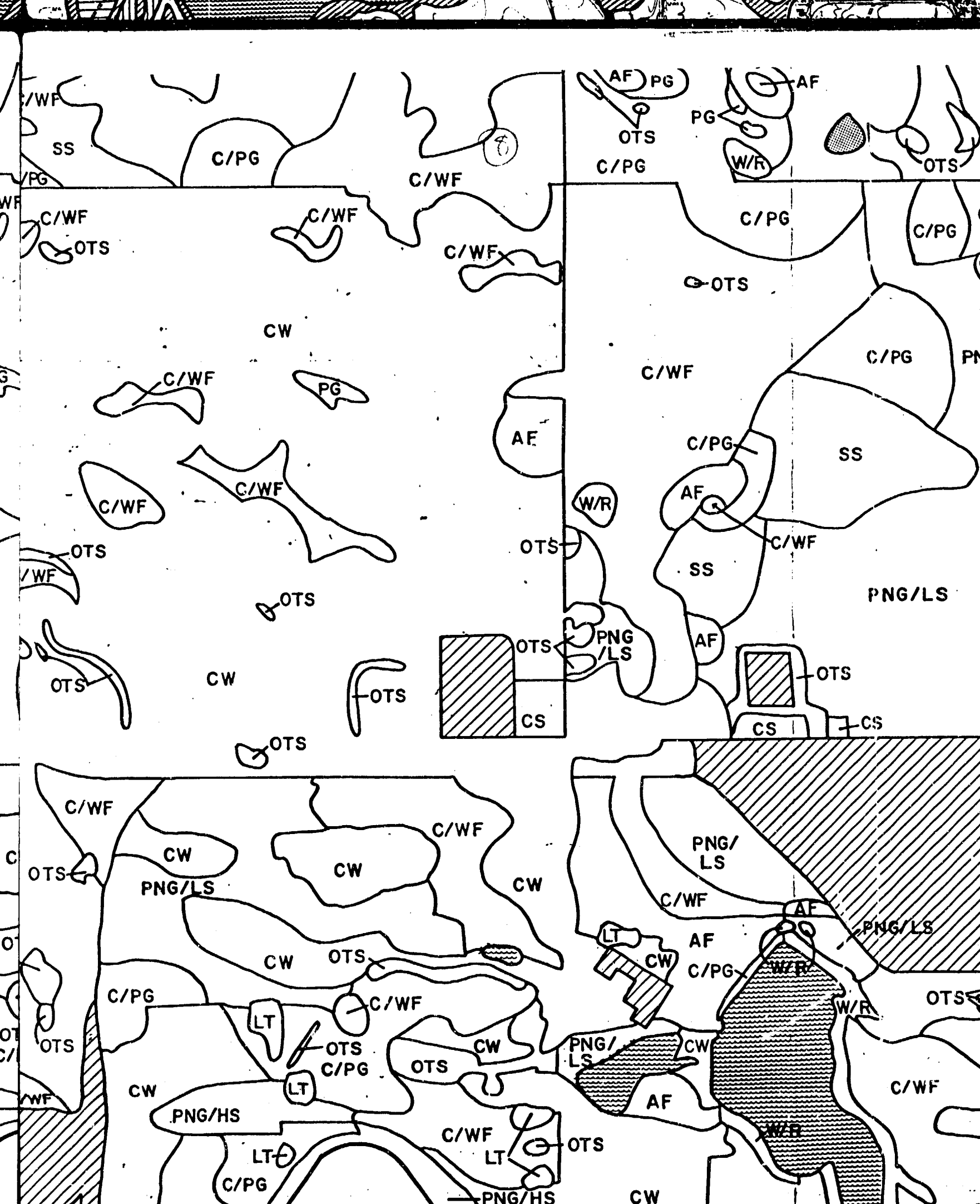
AF	ANNUAL FORBS
C/WF	CHEATGRASS WITH WEEDY FORBS
C/PG	CHEATGRASS WITH PERENNIAL GRASSES
PNG/HS	PERENNIAL NATIVE GRASSES (HEAVIER SOIL)
PNG/LS	PERENNIAL NATIVE GRASSES (LIGHTER SOIL)
CW	CRESTED WHEATGRASS
W/R	WETLAND AND RIPARIAN TYPES
UPLAND SHRUB TYPES	
RR	RUBBER RABBITBRUSH
SB	SAND SAGEBRUSH
LT	LOCUST THICKETS
MISCELLANEOUS MINOR TYPES	
PG	PERENNIAL GRASSES
SS	SUBSHRUBS AND SUCCULENTS
OTS	ORNAMENTAL TREES AND SHRUBS
CS	CULTIVATED SPECIES
	BUILDING COMPLEX
	OPEN WATER
	DISPOSAL AREA

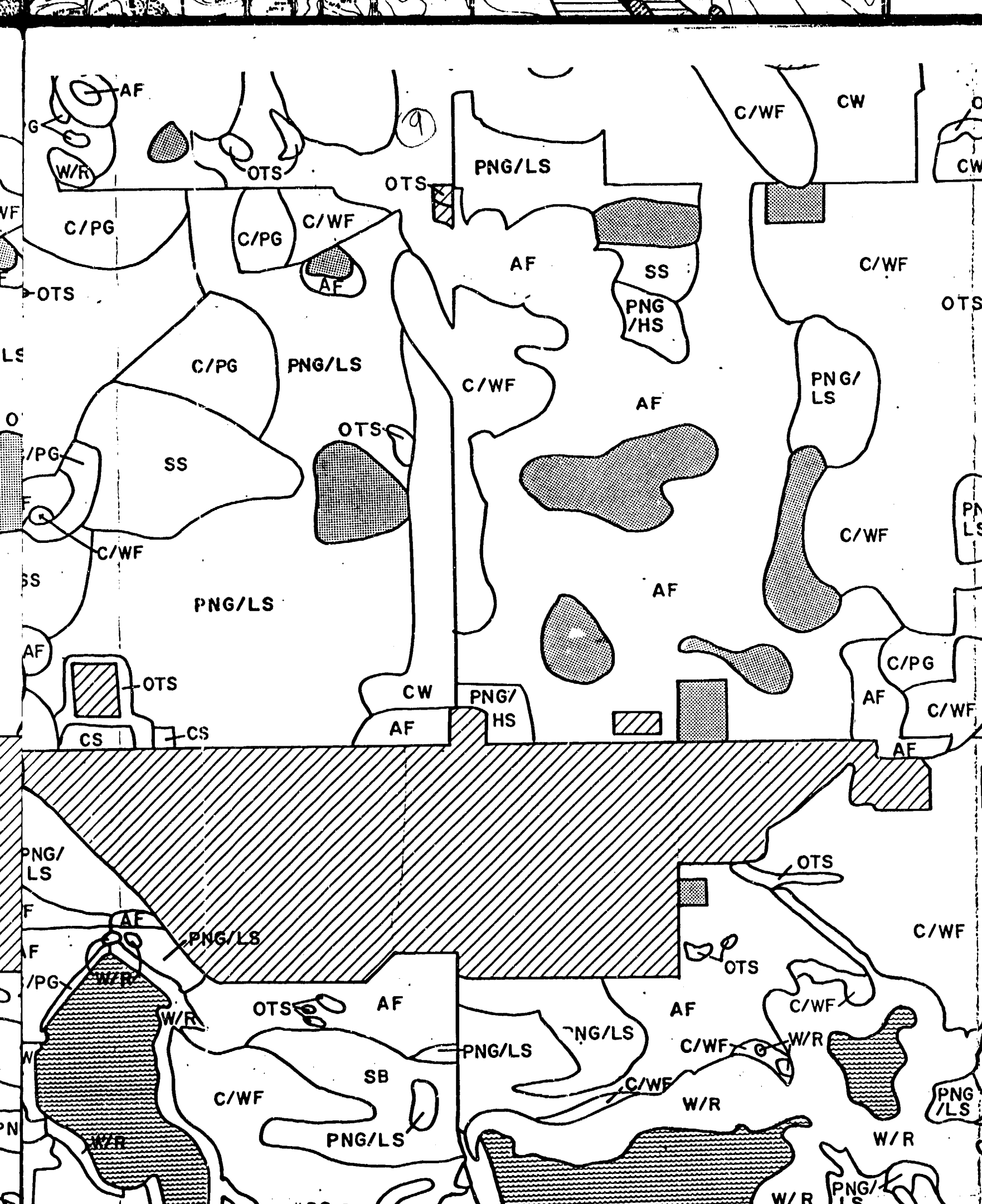
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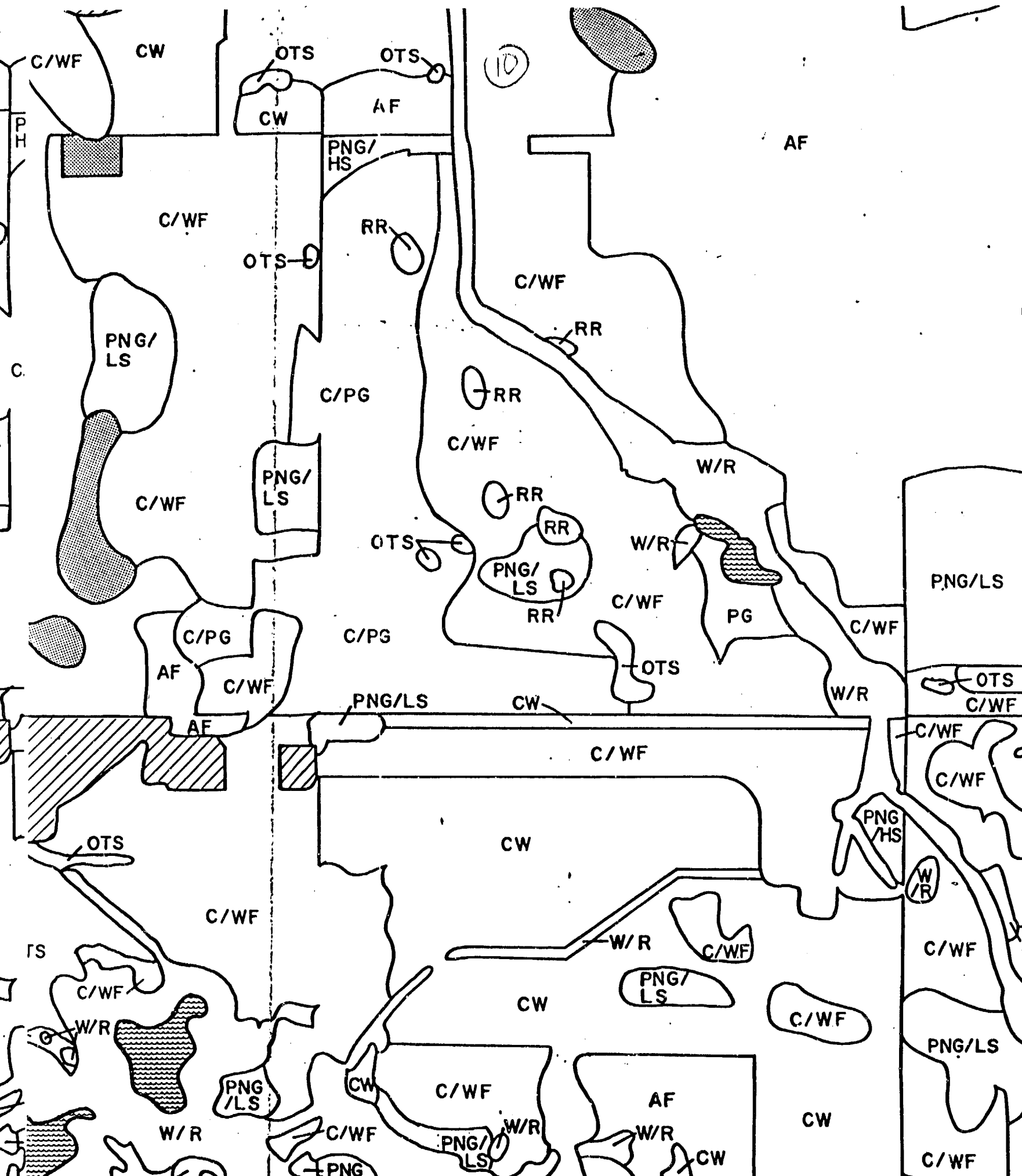
AF	ANNUAL FORBS
C/WF	CHEATGRASS WITH WEEDY FORBS
C/PG	CHEATGRASS WITH PERENNIAL GRASSES
PNG/HS	PERENNIAL NATIVE GRASSES (HEAVIER SOIL)
PNG/LS	PERENNIAL NATIVE GRASSES (LIGHTER SOIL)
CW	CRESTED WHEATGRASS
W/R	WETLAND AND RIPARIAN TYPES
UPLAND SHRUB TYPES	
RR	RUBBER RABBITBRUSH
SB	SAND SAGEBRUSH
LT	LOCUST THICKETS
MISCELLANEOUS MINOR TYPES	
PG	PERENNIAL GRASSES
SS	SUBSHRUBS AND SUCCULENTS
OTS	ORNAMENTAL TREES AND SHRUBS
CS	CULTIVATED SPECIES
	BUILDING COMPLEX
	OPEN WATER
	DISPOSAL AREA

CW

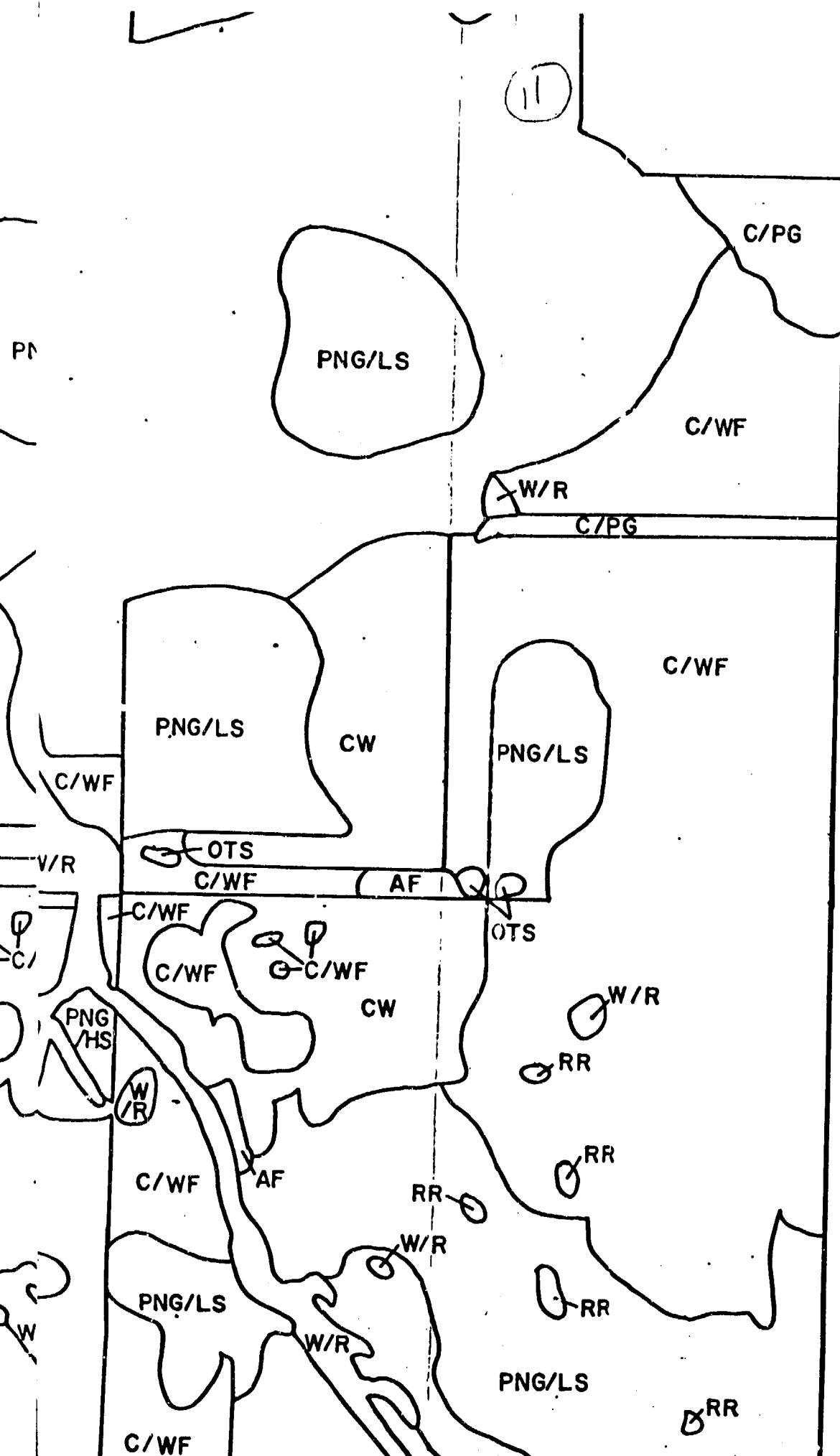








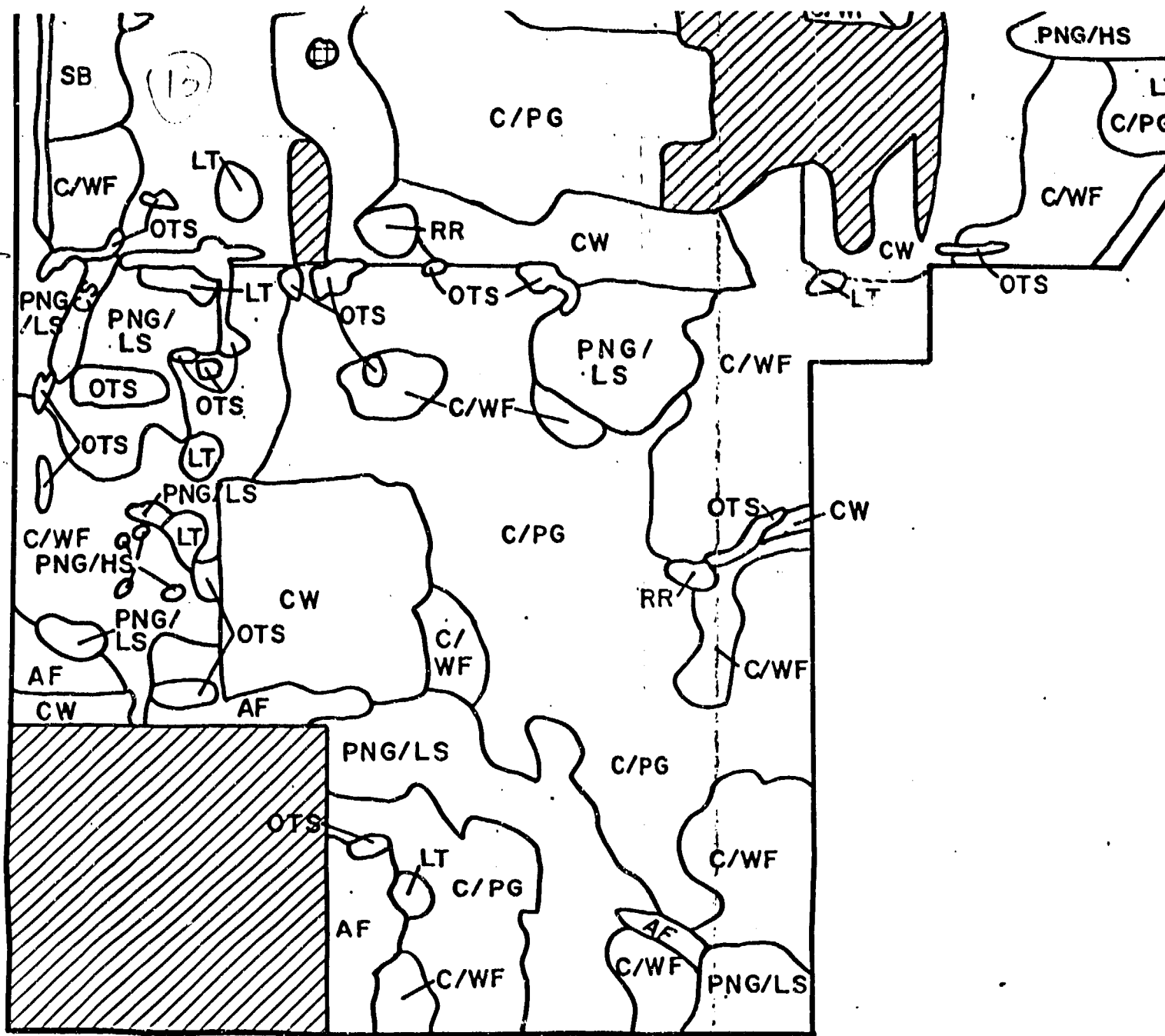
DISPOSAL AREA

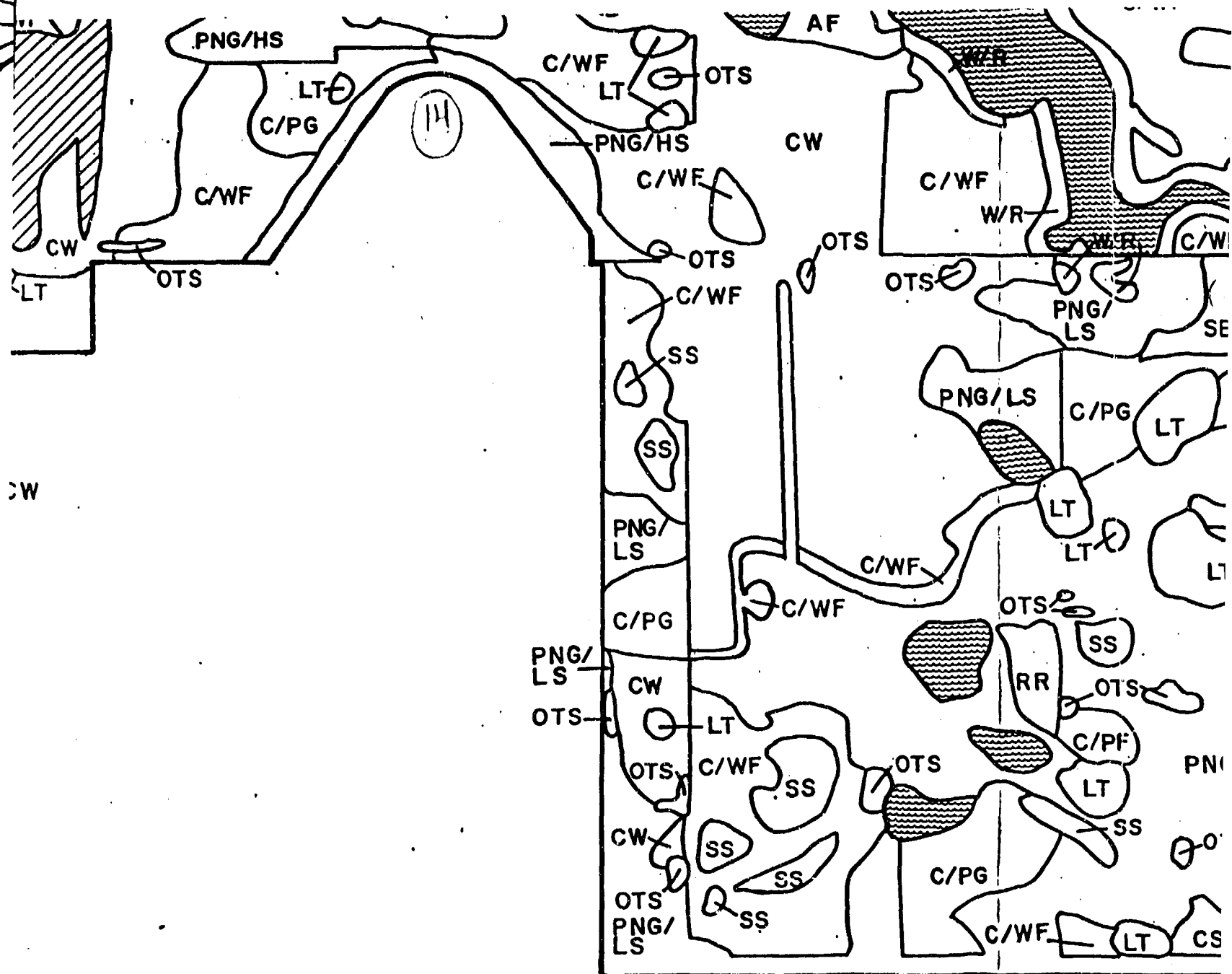


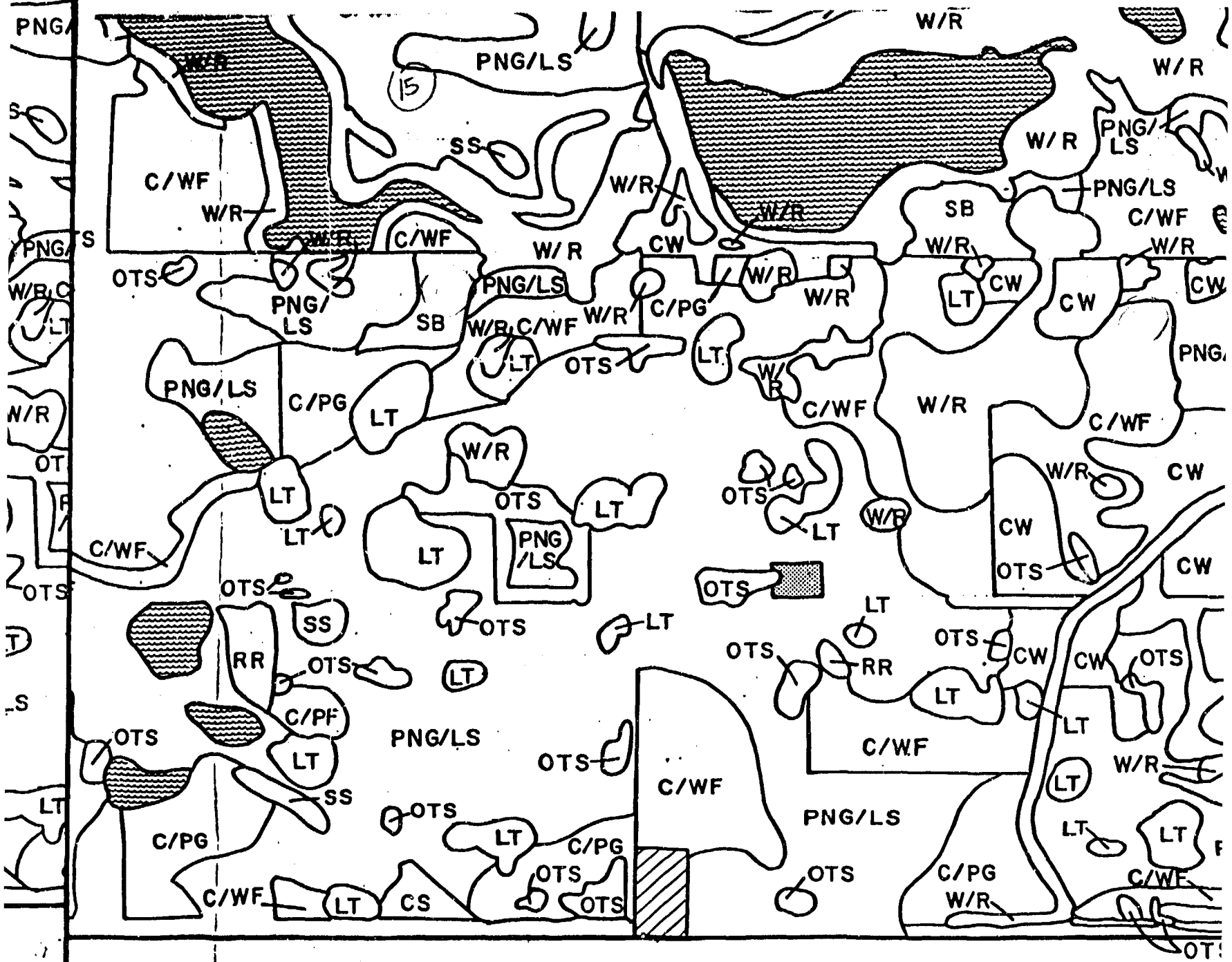
DISPOSAL AREA

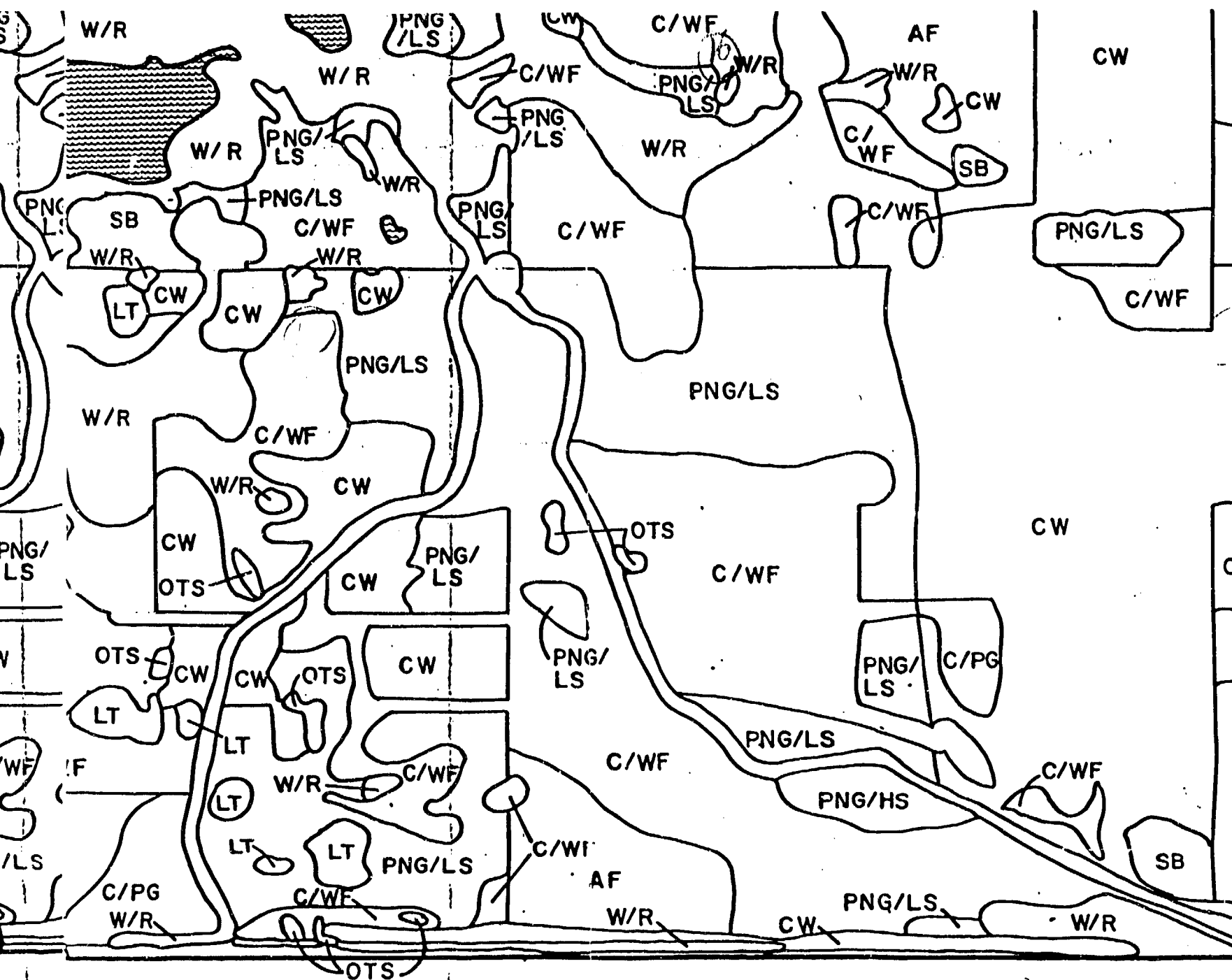
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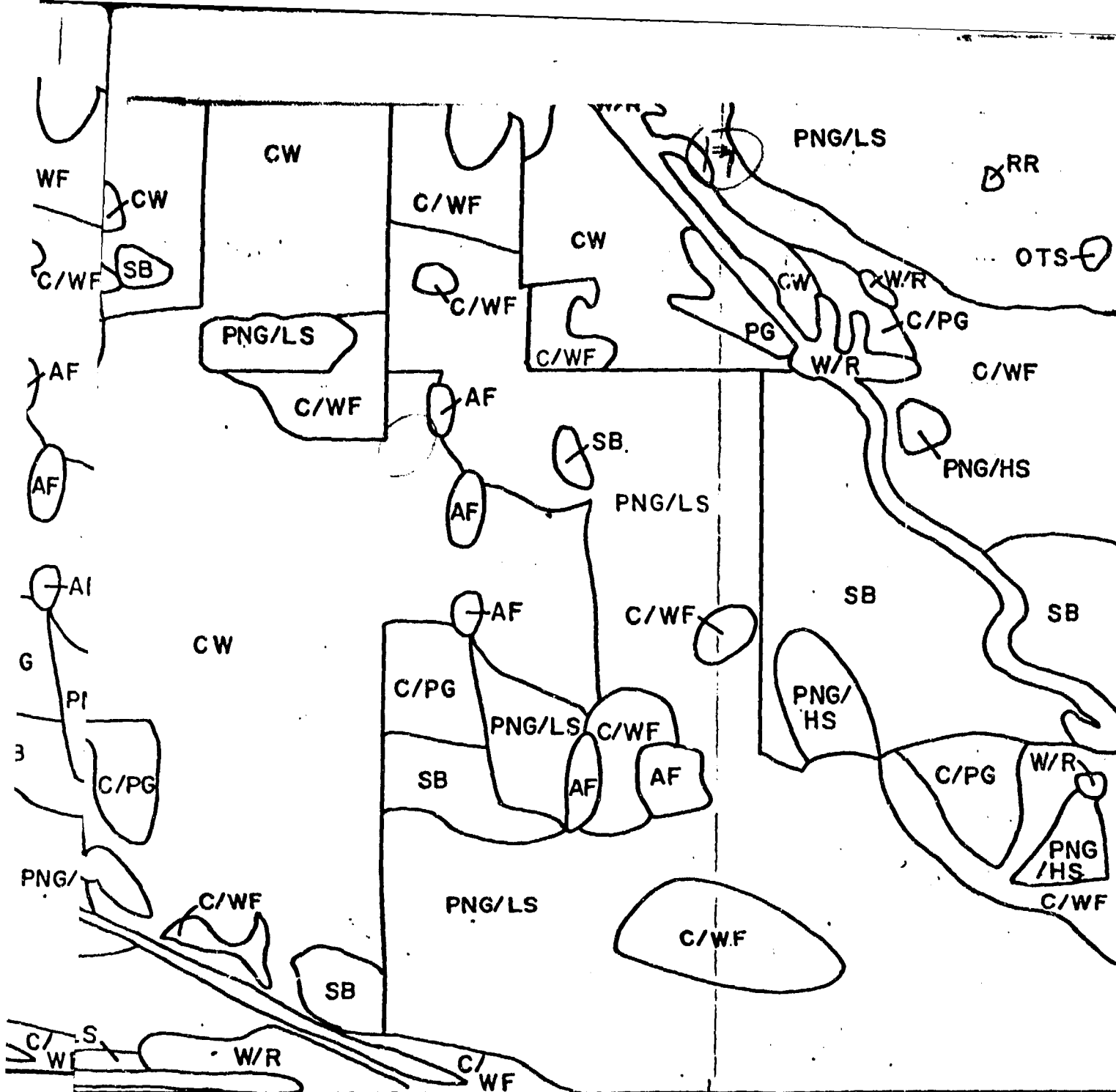












**PRELIMINARY**

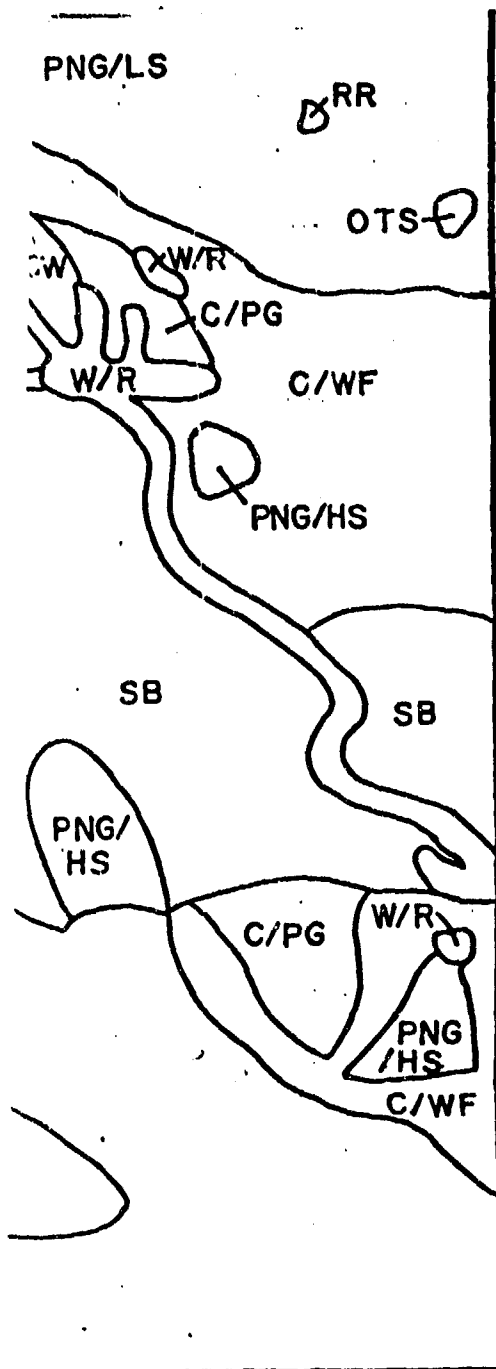
**ROCKY M**

Drawn By:	Date
App'd. By:	
Design By:	Date
App'd. By:	



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ORIGINAL

# PRELIMINARY VEGETATION MAP

## ROCKY MOUNTAIN ARSENAL

Drawn By:	Date:	Scale: 1"=1000'	Exhibit No.
App'd. By:		Date:	
Design By:	Date:	Dwg. No.:	
App'd. By:			



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